MONTHLY WEATHER REVIEW.

Editor: Prof. CLEVELAND ABBE. Assistant Editor: FRANK OWEN STETSON.

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INTRODUCTION.

The MONTHLY WEATHER REVIEW for December, 1905, is based on data from about 3470 stations, classified as follows:

Weather Bureau stations, regular, telegraph, and mail, 176; West Indian Service, cable and mail, 13; River and Flood Service, regular 52, special river and rainfall, 363, special rainfall only, 98; cooperative observers, domestic and foreign, 2565; total Weather Bureau Service, 3267; Canadian Meteorological Service, by telegraph and mail, 33; Meteorological Service of the Azores, by cable, 2; Meteorological Office, London, by cable, 8; Mexican Telegraph Company, by cable, 3; Army Post Hospital reports, 18; United States Life-Saving Service, 9; Jamaica Weather Service, 130.

Since December, 1904, the Weather Bureau has received an average of about 1700 reports from as many observers and vessels, giving international simultaneous observations over the Atlantic and Pacific oceans at 12 noon, Greenwich time, or 7 a. m., seventy-fifth meridian time. These are charted, and, with the corresponding land observations, will form the framework for daily weather charts of the globe.

Special acknowledgment is made of the hearty cooperation of Prof. R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada; Señor Manuel E. Pastrana, Director of the Central Meteorological and Magnetic Observatory of Mexico; Camilo A. Gonzales, Director-General of Mexican Telegraphs; Capt. S.I. Kimball, General Superintendent of the United States Life-Saving Service; Capt. H. M. Hodges, U. S. N. (Retired), Hydrographer, United States Navy; Commandant Francisco S. Chaves, Director of the Meteorological Service of the Azores, Ponta Delgada, St. Michaels, Azores; W. N. Shaw, Esq., Secretary, Meteorological Office, London; H. H. Cousins, Chemist, in charge of the Jamaica Weather Office; Señor Enrique A. Del Monte, Director of the Meteorological Service of the Republic of Cuba; Rev. L. Gangoiti, Director of the Meteorological Observatory of Belen College, Havana, Cuba.

Attention is called to the fact that at regular Weather Bureau stations all data intended for the Central Office at Washington are recorded on seventy-fifth meridian or eastern standard time, except that hourly records of wind velocity and direction, temperature, and sunshine are entered on the respective local standards of time. As far as practicable, only the seventy-fifth meridian standard of time, which is exactly five hours behind Greenwich time, is used in the text of the REVIEW. The standards used by the public in the United States and Canada and by the cooperative observers are believed to conform generally to the modern international system of standard meridians, one hour apart, beginning with Greenwich. The Hawaiian standard meridian is 157° 30′, or $10^h\ 30^m$ west of Greenwich. The Costa Rican standard meridian is that of San José, $5^h\ 36^m$ west of Greenwich.

Barometric pressures, whether "station pressures" or "sea-level pressures", are now reduced to standard gravity, so that they express pressure in a standard system of absolute measures.

In conformity with Instructions No. 43, March 29, 1905, the designation "voluntary", as applied to the class of observers performing services under the direction of the Weather Bureau without a stated compensation in money, is discontinued, and the designation "cooperative", will be used instead in all official publications and correspondence.

Hereafter the titles of the respective forecast districts will be as used in the current REVIEW to accord with paragraph 236 of Station Regulations, dated June 15, 1905.

FORECASTS AND WARNINGS.

By Prof. E. B. GARRIOTT, in charge of Forecast Division.

On December 20 the first regular meteorological observation at noon, Greenwich time, received by the Weather Bureau at Washington from mid-ocean was dispatched through the Marconi Company by the American S. S. *New York*, in latitude 40° north, longitude 48° west. The service of transmitting observations from vessels equipped with the Marconi apparatus is now regularly conducted by the *New York*, *Philadelphia*, *St. Louis* and *St. Paul*, of the American Steamship Line, and an extension of the service to the other steamships, as facilities for transmission and the needs of the Weather Bureau demand, is contemplated.

Along the transatlantic steamer routes east of the Banks of Newfoundland and thence southward over the Azores the weather of the latter part of December was severe. Over the western Atlantic storms of pronounced severity occurred with intervening intervals of about five days.

In the United States a larger proportion of the barometric disturbances crossed the southeastern districts, where the month was cold and wet. The remaining low areas passed from the British Northwest Territory over or near the Great Lakes, and the weather of the northern portions of the United States east of the Rocky Mountains was unusually warm and dry. No well-defined low area traversed the Plateau and Pacific coast States, and the month in those States was generally cool and dry. During the latter half of the month, however, the passage of barometric depressions over the British Possessions was attended by gales on the north Pacific coast.

The first important storm of the month in the United States moved from the southeastern portion of the Gulf of Mexico to the Canadian Maritime Provinces from the 8th to 10th. This storm increased in strength during its passage up the coast, and on the 10th was attended by wind velocities of 60 miles an hour on the New York and New England coasts. Five days later a storm that had apparently originated in the subtropical regions of the West Indies appeared off Hatteras and moved slowly northeastward. Vessel reports indicate that from the 14th to 16th the gales that attended this storm were violent. Under the influence of this low area, and of high area VI, the first snowstorm of the season in the Middle Atlantic States occurred on the 15th. Low area IX was attended by heavy rain in the west Gulf States on the 19th, and in the east Gulf and South Atlantic States on the 20th. During the 20th low area IX*a* moved northward near the south Atlantic coast causing heavy rain at night in the Middle Atlantic States.

On the 28th low area XII developed marked intensity over the middle Mississippi Valley; during the 29th it moved northeastward over the upper Lakes, with high winds that extended over the middle Atlantic and New England coasts, heavy rains in Eastern and Southeastern States, and rain or snow in the Lake region. On the 30th barometric pressure below 29.00 inches attended the passage of the low area over the Canadian Maritime Provinces.

In advance of high area III the principal cold wave of the month swept from the Northwestern States to the Atlantic coast, carrying the line of freezing temperature southward to the middle Gulf coast, and causing light frost at Jacksonville, Fla., on the mornings of the 4th and 5th. On the 25th and 26th heavy frosts occurred on the Gulf coast and light frost at Jacksonville. In California the latter part of the month was cold, with snow in the mountains and frost in the citrus fruit districts.

On the 11th four inches of snow fell at El Paso, Tex.

BOSTON FORECAST DISTRICT.

Four well-defined storms, attended by moderate to heavy precipitation, and by gales along the coast, visited New England; the gale of the 10-11th wrecked the Nantucket lightship No. 58 which had weathered many great storms. Timely warnings alone prevented the loss of many staunch vessels during the month.—*J. W. Smith, District Forecaster.*

NEW ORLEANS FORECAST DISTRICT.

No severe windstorms occurred in the Gulf States and conditions did not justify cold-wave warnings. Frost warnings were issued on several dates, and the warnings were generally justified. Freezing temperature, for which timely warnings were issued, occurred in the sugar and trucking regions on the 4th and 5th.—*I. M. Cline, District Forecaster.*

LOUISVILLE FORECAST DISTRICT.

Several pronounced disturbances passed over the district. Cold-wave warnings were not issued or required.—*F. J. Walz, District Forecaster.*

CHICAGO FORECAST DISTRICT.

The month was exceptionally free from gales, the temperature continued mild, and but little rain or snow fell.

No warnings for general cold waves were issued, and warnings of heavy snow were not required.—*H. J. Cox, Professor and District Forecaster.*

DENVER FORECAST DISTRICT.

In New Mexico the month was unusually cold, and in the southeastern part of that territorry heavy snow was a feature; elsewhere in the middle and southern Rocky Mountain districts the month was dry and cool. Several sharp falls in temperature, of a local character, occurred and warnings were issued on the morning of the 29th for a cold wave that visited northern Arizona.—*F. H. Brandenburg, District Forecaster.*

SAN FRANCISCO FORECAST DISTRICT.

The month, as a whole, was one of deficient rainfall. Severe sandstorms occurred in the valleys of southern California on the 9th. The most important work of the month was in connection with the frost warnings.—*A. G. McAdie, Professor and District Forecaster.*

PORTLAND FORECAST DISTRICT.

No important storms occurred on the north Pacific coast until the 16-18th. On those dates, and on the 24th and 25th, 28th and 29th, severe weather attended the passage of barometric depressions from the Pacific.

Storm warnings were ordered in advance of the gales. Cold-wave warnings were not issued or required.—*A. B. Wollaber, Acting District Forecaster.*

RIVERS AND FLOODS.

The heavy rains of November 29 and December 3 caused a moderate flood in the Allegheny and Monongahela rivers. As a rule, danger-line stages were not quite reached, except at Pittsburg, where the crest stage on December 4 was 23.5 feet or 1.5 feet above the danger line. As usual, all interests were given timely warning, and no damage was reported.

The same general conditions produced a decided rise in the Ohio River without danger-line stages. No inconvenience resulted, except in the vicinity of Evansville, Ind., where the rising water necessitated the removal of a large amount of freight on the levee. Warnings of the rise were sent to Evansville on the 3d, and the crest stage of 32 feet was reached on the 9th.

The Missouri and upper Mississippi rivers were somewhat lower than during the preceding month, while the lower Mississippi rose from five to seven feet on account of the rise in the Ohio River and a supplementary rise out of the Red River. There were no high waters of consequence during the month, except in the Carolinas, where the heavy rains of the 21st were followed by moderate floods on the 22d and 23d, with stages as a rule somewhat above the danger lines.

Owing to the mildness of the season there was much less ice in the rivers at the end of the year than at the corresponding period of the year 1904, except in the extreme upper Missouri River, where the quantity was somewhat in excess of that of the previous year. The Mississippi was open below Leclaire, Iowa, and none of the eastern rivers, except those of northern New England, were closed.

The highest and lowest water, mean stage, and monthly range at 279 river stations are given in Table VI. Hydrographs for typical points on seven principal rivers are shown on Chart V. The stations selected for charting are Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.—*H. C. Frankenfield, Professor of Meteorology.*

CLIMATE AND CROP SERVICE.

By Mr. JAMES BERRY, Chief of Climate and Crop Divison.

The following summaries relating to the general weather and crop conditions during December are furnished by the directors of the respective sections of the Climate and Crop Service of the Weather Bureau; they are based upon reports from cooperative observers and crop correspondents, of whom there are about 3300 and 14,000, respectively:

Alabama.—The month, as a whole, was moderately cold, wet, and unfavorable for farm work; freezing temperatures prevailed on several dates; rains were frequent, but not damaging to land. Little progress was made in seeding oats and wheat, though the early sown made good growth. The little cotton outstanding at beginning of month was about all gathered by the 15th, after being damaged somewhat by wet weather. Late fall crops were all housed, with satisfactory yields.—*F. P. Chaffee.*

Arizona.—Temperature greatly deficient. Precipitation slightly below normal. There was an unusual depth of snowfall in the northern section. Plowing and seeding for winter wheat, barley, and oats progressed satisfactorily. Citrus fruits yielded largely; olive picking continued. Vegetables were abundant and growing well in the central and southern sections. Ranges were in excellent condition in the southern, and covered by snow in the northern counties. There was a bountiful supply of water; all river beds were full during the entire month.—*L. N. Jesunofsky.*

Arkansas.—Temperature decidedly below and precipitation slightly above the normal. The month was unfavorable for farm work on account of the cold, wet weather, and not much was accomplished. Wheat, oats, and rye made fair growth and did well. Late crops about all secured. Some cotton unpicked, but badly damaged as a result of the wet weather. Pastures still good and stock doing well. Fruit in fair condition.—*Chas. M. Strong.*

California.—Weather conditions during almost the entire month were unfavorable for agricultural interests. The temperature and precipitation were much below normal. Severe frosts near the end of the month

killed tender vegetation and caused some injury to unprotected citrus fruits in southern California. The loss to orange growers was minimized by ample warnings of the Weather Bureau. Severe sandstorms and high winds in the south damaged oranges to some extent. Rain at close of the month was beneficial.—*Alexander G. McAdie.*

Colorado.—Grazing was temporarily interrupted by snow in parts of Weld, Jefferson, and Rio Grande counties, and throughout the month in Garfield County; in other parts of the State the weather conditions were exceptionally favorable to live stock and grazing. Feeding had not become general by the close of the month. Cattle, horses, and sheep were reported to be in good condition on the ranges. In a few localities a scarcity of stock water was being felt.—*Frederick H. Brandenburg.*

Florida.—The temperature of the month was below normal, but the precipitation exceeded the normal by more than four inches. Excessive rains rendered low lands unfit for cultivation and destroyed many early vegetables in the southern district. The rainy weather caused some oranges to drop and delayed the work of harvesting the fruit. Early plantings of oats made good progress and sowing continued at the close of the month. Much replanting of vegetables will be necessary in the southern district.—*A. J. Mitchell.*

Georgia.—Abnormally low mean temperature, an unusual amount of cloudiness, and excessive rainfall characterized the December weather. Fall plowing and grain seeding were retarded by excessive moisture. Grains germinated to good stands and made rapid growth. No injury resulted from cold. Wheat acreage was increased in some sections. A considerable amount of fall plowing was done. Fruit trees were uninjured and in good condition. Stock was doing well.—*J. B. Marbury.*

Hawaii.—The month was showery in most sections of the group, with rather heavy rains in windward Hawaii and windward Maui; abnormally low temperatures were general during the second decade. Young cane grew slowly and suffered considerable damage in many localities from high winds during the second week. Conditions were, on the whole, rather favorable for field operations, and grinding of 1906 cane became general by the close of the month. Ripening of winter pineapples was retarded by cool and partly cloudy weather. Coffee picking continued all the month and was practically completed in leeward Hawaii. Harvesting of winter rice was completed early in the month; this was followed by general plowing of rice patches. The showery conditions were quite favorable for pasture lands. Sisal grew well.—*Alex. McC. Ashley.*

Idaho.—The month was characterized by continuously cold weather, though no extremely low temperatures were experienced. There was a good snow covering on winter wheat fields, and fruit and shade trees were believed to be in good condition. More than the usual amount of snow lay on the winter ranges, but there was sufficient feed and stock was in good condition.—*Edward L. Wells.*

Illinois.—The condition of wheat continued excellent, notwithstanding deficiency in moisture and some alternate freezing and thawing, and its chief requirement at end of month was a covering of snow. Husking, cribbing, and shelling of corn continued, the crop being mostly garnered by the 15th. In localities where apples were gathered the fruit, owing to inferior quality, was not keeping well. Potatoes were rotting badly and a general shortage was reported.—*Wm. G. Burns.*

Indiana.—Wheat, rye, timothy, and young clover were generally in excellent condition, though, owing to absence of snow protection, they suffered slightly from freezing and thawing; too much rain was also slightly detrimental to these crops on southern lowlands. Much old clover appeared to be dead. Tobacco was being stripped and marketed. Corn gathering was practically finished. Stalk fields and pastures afforded sufficient feed for grazing stock until near the end of month, when some feeding became necessary in the northern and central sections.—*W. T. Blythe.*

Iowa.—December was one of the fairest winter months ever known in this State, the temperature being above and the precipitation below normal. There were no severe storms and the average number of clear days was 19. Conditions were unusually favorable for completing corn gathering, and farm stock was grazing in the fields nearly every day. Winter wheat and rye showed no damage from freezing.—*John R. Sage.*

Kansas.—The month was dry, but the ground continued moist. Wheat was in good condition. Corn was nearly all cribbed. Spring plowing progressed in the southern part of the State. The range was good and cattle were in good condition. There was but little wind.—*T. B. Jennings.*

Kentucky.—The weather was favorable to winter crops, with no severe freezing weather or cold waves, though rainfall was excessive on the 2–3d. Several rainstorms occurred the later half of month, with snow and sleet on the 15th and gales on the 28–29th. Wheat appeared very promising at close of month, though some little damage resulted from alternate freezing and thawing. Fall sown grasses suffered somewhat from like cause. Pastures remained good and stock was in excellent condition for winter. Winter oats and rye were well advanced.—*F. J. Walz.*

Louisiana.—Frequent rains during the month retarded agricultural operations. Very little progress was made in preparing for spring crops, except in scattered localities. Oats and rye made good growth. Sugar harvest was materially interfered with by rains and, as a result of unfavorable weather and the heavy tonnage in some sections, grinding will not be completed on some plantations until in February. Winter gardens made fairly good growth.—*I. M. Cline.*

Maryland and Delaware.—December was a month of mild temperature and an ample amount of precipitation, both being considerably above normal. The only cold wave of any consequence was that of the 18th and 19th, and this was confined to western counties and did no damage, owing to the protection afforded by several inches of snow on the ground. Wheat and grasses improved greatly and were in excellent condition at the close of the month. Plowing for spring sowing was commenced.—*C. F. von Herrmann.*

Michigan.—The weather conditions during December were generally favorable to winter wheat and rye. The soil was quite dry and the ground generally bare of snow during the first two decades; ample moisture and a partial snow blanket obtained during the last ten days of the month. Wheat and rye made very little winter growth, but were generally in good condition at the close of the month; both seedings showed generally good, healthy stands.—*C. F. Schneider.*

Minnesota.—The monthly mean temperature was considerably above normal. The precipitation, which was all snow, was much below normal. The snow depth ranged from 3 inches in south to 15 inches in north early in the month, but gradually diminished. Work in the lumber regions was delayed by poor roads, as the swamps were not frozen hard before snow fell. The usual winter farm work was pursued. Building work experienced little interruption.—*T. S. Outram.*

Mississippi.—Excepting fairly favorable conditions during the first decade, when cotton picking was practically completed, much cloudy, rainy weather prevailed, which materially hindered preparations for the coming season. The soil was generally too wet for plowing. Very little seeding was done. Although the mean temperature was much below normal, there was no severe cold weather. Numerous heavy frosts occurred to the coast line.—*W. S. Belden.*

Missouri.—Although the weather during December was but little warmer than the normal, the temperature was remarkably uniform, which, together with a light rainfall and high percentage of sunshine, made it an unusually pleasant winter month. There were no severe storms or cold waves. The weather conditions were generally favorable for winter wheat; in a few south-central counties slight damage was reported as a result of alternate freezing and thawing, but the crop as a whole was in good condition. The cribbing of corn was completed.—*George Reeder.*

Montana.—Uniformly mild temperatures and absence of heavy snows made the month unusually favorable for stock. November snow remained in some western counties and became crusted on the ranges. Ranges were open and in good condition throughout the month in the eastern counties. Cattle, sheep, and horses were mostly wintering well, with little loss so far. In the principal wheat growing counties the fields were covered with several inches of snow till the close of the month, and all grain that germinated in the fall was in good condition.—*R. F. Young.*

Nebraska.—The dry weather and moderate temperature of the month allowed rapid progress to be made with corn husking, and most of the corn was secured before the end of the month. Winter wheat and rye retained a green color throughout the month and were generally a fine stand. Winter wheat was somewhat above average in condition. The month was very favorable for stock interests, with no storms or severe weather.—*G. A. Loveland.*

Nevada.—The temperature was 8° below normal, and the lowest in seventeen years; there was a marked deficiency in every section of the State. The precipitation was 1.28 inches below normal in the western section, and slightly below elsewhere. Stock and beef cattle and mutton sheep fed on ranches made the desired gains; range stock was generally in fair condition, but began to suffer in some localities from the extended cold weather.—*H. F. Alps.*

New England.—The weather was exceptionally pleasant, considering the season, precipitation occurring on an average of only eight days. Notwithstanding the few days with rain or snow, the average precipitation was somewhat above the normal. The weather was very favorable to outdoor work, although more snow was needed for successful logging. Generally speaking, there was little frost in the ground at close of month. Stock was wintering very well.—*J. W. Smith.*

New Jersey.—The month was noted for its exceptionally mild temperature and well distributed rains. Plowing was possible almost every day in the southern section. Early sown wheat, rye, and meadows were very much improved by the rains, but the late sown wheat showed a poor stand and was thin on the ground. Frequent freezing and thawing did no injury. The snowfall was very light in all sections.—*Edward W. McGann.*

New Mexico.—December was a very cold month, averaging for the Territory nearly 4° below the normal. The precipitation was above the average, except in the extreme northern portion. The snowfall over the plains and in the mountain districts of the central portion was remarkably heavy, and at the end of the month the snow varied in depth over the plains from six inches to three feet and in the mountains from three to eight feet. Range grass was plentiful; stock remained in good condition and no losses were reported.—*J. B. Sloan.*

New York.—The weather averaged unusually mild and pleasant for

SUMMARY OF TEMPERATURE AND PRECIPITATION BY SECTIONS, DECEMBER, 1905.

In the following table are given, for the various sections of the Climate and Crop Service of the Weather Bureau, the average temperature and rainfall, the stations reporting the highest and lowest temperatures with dates of occurrence, the stations reporting greatest and least monthly precipitation, and other data, as indicated by the several headings.

The mean temperatures for each section, the highest and lowest temperatures, the average precipitation, and the greatest and least monthly amounts are found by using all trustworthy records available.

The mean departures from normal temperature and precipitation are based only on records from stations that have ten or more years of observation. Of course the number of such records is smaller than the total number of stations.

Section.	Temperature—in degrees Fahrenheit.								Precipitation—in inches and hundredths.					
			Monthly extremes.								Greatest monthly.		Least monthly.	
	Section average.	Departure from the normal.	Station.	Highest.	Date.	Station.	Lowest.	Date.	Section average.	Departure from the normal.	Station.	Amount.	Station.	Amount.
Alabama	43.7	— 2.5	Daphne, Wetumpka.	75	22	Riverton	14	4	6.46	+2.14	Opelika	11.72	Thomasville	2.96
Arizona	41.9	— 3.6	Parker, Vail	77	21, 14	Fort Defiance	—20	23	1.55	—0.06	Nutrioso	4.11	Aztec	0.20
Arkansas	38.5	— 3.7	Bee Branch	70	8	Oregon	7	4	4.96	+0.84	Howe	7.80	Silver Springs	1.70
California	45.3	— 1.9	Escondido	90	7	Bodie	—21	23	1.55	—2.43	Monumental	11.86	7 stations	0.00
Colorado	22.1	— 2.9	Trinidad	68	16	Gunnison	—46	23	0.20	—0.57	Hahns Peak	1.31	11 stations	0.00
Florida	58.0	— 1.3	Avon Park, Caxambas	90	21, 3	Madison, Middleburg	23	21, 11	7.50	+4.64	Jupiter	15.18	St. Augustine	3.33
Georgia	44.5	— 2.3	Fleming	81	22	Diamond	13	11	8.56	+4.48	Quitman	11.60	Carrollton	3.40
Hawaii	†69.5		Olaa Mill, Hawaii	91	3, 19	2 stations	46	13, 24	‡6.13		Nahiku, Maui	25.51	Kekaha, Kauai	0.04
Idaho	24.5		Oakley	60	17	Chesterfield	—22	28	1.32		Hope	3.95	Lost River	0.10
Illinois	31.4	+ 1.6	4 stations	60	7, 11	Martinton	— 3	24	1.99	—0.27	Raum	4.53	Zion	0.44
Indiana	32.8	+ 0.9	Bloomington	63	26	Logansport	— 1	24	2.42	—0.43	Jeffersonville	5.58	Markle	0.81
Iowa	27.0	+ 4.0	Jefferson	62	8	Monticello	—11	23, 24	0.52	—0.73	Ottumwa	1.69	2 stations	T.
Kansas	33.0	+ 0.1	Valley Falls	67	11	Norton, Wallace	2	31, 31	0.18	—0.87	Columbus	1.53	9 stations	0.00
Kentucky	37.3	+ 0.3	Burnside	66	27	Greensburg	11	25	4.38	+0.58	Alpha	6.12	West Liberty	2.00
Louisiana	46.6	— 4.9	Schriever	79	2	Ruston	19	5	5.91	+1.46	New Orleans	14.43	Lakeside	2.54
Maryland and Delaware	36.6	+ 1.9	Millsboro, Del	64	3	Frederick, Md	2	18	4.36	+1.14	Millsboro, Del	6.21	Deer Park, Md	2.41
Michigan	28.4	+ 3.2	Bloomingdale, Coldwater	60	7, 27	Humboldt	—26	14	1.58	—0.76	Ishpeming	3.70	Menominee	0.15
Minnesota	20.6	+ 4.7	Amboy, Windom	55	26	Park Rapids	—22	1	0.15	—0.62	Caledonia	0.96	3 stations	0.00
Mississippi	43.4	— 4.6	Quitman	75	22	4 stations	18	5, 6	5.64	+0.91	Pearlington	14.34	Canton	3.49
Missouri	33.3	+ 0.3	Arthur	66	7	Unionville	— 2	24	1.45	—0.74	New Madrid	5.02	Rockport	T.
Montana	23.9	— 0.1	St. Pauls	61	15	Grayling	—36	22	0.25	—0.52	Columbia Falls	2.79	7 stations	0.00
Nebraska	29.9	+ 2.4	Bartley	65	12	Hay Springs	—14	3	0.02	—0.53	2 stations	0.20	50 stations	0.00
Nevada	22.5	— 8.0	Martins Ranch	68	4	Potts	—21	23	0.60	—0.43	Eureka	1.69	McAfees Ranch	0.00
New England*	28.6	+ 2.1	Norfolk, Mass	62	3	Enosburg Falls, Vt., Van Buren, Me	—28	15, 12	3.59	+0.43	Bar Harbor, Me	7.61	Oquossoc, Me	1.47
New Jersey	36.3	+ 2.5	6 stations	61	3, 29	Layton	5	18	3.65	—0.07	Woodbine	5.60	River Vale	2.58
New Mexico	29.7	— 3.9	Fort Union	73	16	Datil	—18	23	1.04	+0.05	Laguna	5.54	Dorsey	0.00
New York	29.7	+ 2.7	Indian Lake	65	30	Paul Smiths	—27	15	3.07	+0.16	Adams Center	7.32	West Berne	0.56
North Carolina	41.5	— 0.7	Nashville	76	21	Buck Spring	0	4	6.98	+3.16	Southport	11.93	Buck Spring	4.57
North Dakota	15.6	+ 3.0	Oakdale	55	15	Pratt	—34	4	0.16	—0.33	Hamilton, Walhalla	1.10	10 stations	T.
Ohio	32.9	+ 1.9	Findlay, Ironton	58	8, 12	Hudson	2	1	2.25	—0.55	Pulse	4.69	Dayton (2)	1.10
Oklahoma and Indian Territories.	38.0	— 1.4	Chattanooga	80	1	3 stations	9	3 dates	1.26	—0.40	Ravia	3.64	Kenton	T.
Oregon	36.2	— 1.6	Port Orford	64	11	Burns, Granite	—10	21, 3 d't's	4.98	—1.22	Glenora	24.48	Silver Lake	0.07
Pennsylvania	33.6	+ 2.8	Philadelphia (c)	65	3	Saegerstown	— 5	1	3.57	+0.26	Uniontown	5.48	Erie	0.95
Porto Rico	74.8		3 stations	92	3 dates	Adjuntas	49	8	2.89		Caguas	7.08	Hac. Coloso	0.15
South Carolina	45.2	— 2.1	Walterboro	77	23	Greenville	16	3 dates	7.25	+3.96	Chappels	11.18	Kingstree	3.18
South Dakota	25.9	+ 3.4	Dallas	67	7, 15	Kidder, White Horse	—22	1, 31	0.04	—0.56	Clark	0.45	5 stations	0.00
Tennessee	39.1	— 1.3	Iron City	67	22	Hohenwald, Rugby	9	5	4.98	+0.80	Isabella	9.18	Brownsville	2.90
Texas	43.9	— 5.5	Fort Ringgold	86	8	Texline	7	29	3.62	+1.47	Jefferson	10.54	Texline	0.00
Utah	22.8	— 5.3	Rockville	63	15	Strawberry Valley	—32	10	0.62	—0.42	Payson	2.30	3 stations	T.
Virginia	37.7	— 0.4	3 stations	68	21, 23	Lincoln	3	18	5.10	+2.09	Dinwiddie	8.24	Marion	3.21
Washington	34.5	+ 0.2	Coupeville	60	4	Cusick	— 4	31	4.04	—1.28	Clearwater	20.11	Sunnyside	0.37
West Virginia	35.6	+ 1.4	Charleston, Logan	70	2, 27	Bayard	3	1	3.11	+0.17	Cairo	5.24	Creston	1.30
Wisconsin	24.1	+ 4.3	Appleton	56	9	Grantsburg	—24	6	1.04	—0.34	Sturgeon Bay	2.66	Grantsburg	T.
Wyoming	19.3	— 3.3	Chugwater	65	16	Norris Geyser Basin, Thumb, Y. N. P.	—30	22, 22	0.40	—0.51	Grand Can., Y.N. P.	1.75	3 stations	0.00

* Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut. † 49 stations, with an average elevation of 636 feet. ‡ 133 stations.

December. The temperature was generally above normal, except from the 14th to 16th, which was the coldest period of the month. The precipitation was slightly above normal, but the snowfall was very light, except in the Adirondack region. Winter grains appeared to be in fairly good condition, and stock was wintering well. There was very little sleighing, and practically no ice had been harvested thus far.—*W. C. Devereaux.*

North Carolina.—The weather was not favorable for outdoor work, owing to the excessive precipitation, but the rains were greatly needed and were very beneficial to fall sown grain, which was very backward owing to the preceding dry weather. In some localities the rains were so heavy as to do considerable damage to crops by washing. No severe freezing weather occurred during the month, and there were no reports of damage to truck crops under glass. Lettuce did exceptionally well.—*A. H. Thiessen.*

North Dakota.—The month was generally mild and pleasant, with but very light snowfall, which allowed stock on the ranges to graze the entire month, while there was sufficient snow on the ground to satisfy their thirst.—*B. H. Bronson.*

Ohio.—December was warmer than the normal and there was less rainfall than usual. The weather was generally pleasant and favorable for farm work. There was very little snow protection over the fields, yet the weather was so mild that neither grass nor grain fields suffered to any marked extent. Wheat and rye were in fair condition at the close of the month. Corn husking was carried on rapidly, and some plowing was done. Tobacco stripping progressed well.—*J. Warren Smith.*

Oklahoma and Indian Territories.—The temperature was slightly below normal. The rainfall was deficient, but ample for present requirements. Weather favorable for gathering outstanding crops and for plowing, and considerable progress was made. Wheat was in good condition and was being pastured; some late planted showed a thin stand. Cotton was about all picked; lint of good quality. Ample forage crops secured to provide winter feed. Range fairly good and stock doing well; some being fed. Fruit trees uninjured.—*J. P. Slaughter.*

Oregon.—The bulk of the wheat was unprotected by snow at the end of the month. Considerable freezing and thawing weather occurred, but as there were no severe cold spells, the crop was not harmed. Except in the colder sections, where growth was at a standstill, fall wheat had a thrifty appearance. Pasturage was poorer than last year, and more than the usual amount of extra feeding of stock was necessary.—*Edward A. Beals.*

Pennsylvania.—December weather conditions were unusually favorable for outdoor work and the growth of grain and grass. The month closed with soil thoroughly saturated and bare of snow. Winter grain reported

well set and thrifty, and but few fields were injured by lack of snow protection.—*T. F. Townsend.*

Porto Rico.—The rainfall was considerably below normal in most districts. Dry weather was favorable for the older canes, but detrimental to the newly planted. Sugar-making began in the south during the middle of the month; grade of juice below normal. In the north and east canes were not sufficiently matured for grinding. Sowing and transplanting of tobacco was active and general and the crop was doing well. October sowings were cut; yield average, with a good per cent of wrappers. Coffee picking continued in the highlands. Oranges abundant. Small crops scarce in places. Pastures and cattle in good condition.—*E. C. Thompson.*

South Carolina.—Although the mean temperature was below normal, there was little freezing weather, a condition favorable for the germination of wheat and oats, which attained good stands. The precipitation was excessive, which interfered with plowing and seeding. The weather conditions were favorable for winter truck in the coast truck regions, and it was in a promising stage of growth. Over the greater portion of the State the ground was thoroughly saturated, and streams had more than their normal flow of water.—*J. W. Bauer.*

South Dakota.—The month was warmer than usual, with very little precipitation. Live stock did well and was in good winter condition, but in some northern counties November snow remaining on the ground hindered grazing on the ranges part of the month and necessitated more than the usual feeding from stack. In some southern counties absence of snow covering part of the month was considered unfavorable for winter grains, though no special injury was apparent. The month closed with very little corn in the fields.—*S. W. Glenn.*

Tennessee.—The weather was generally favorable to winter grains. There was no serious damage from freezing. The rainfall was ample, being considerably more than the normal in the eastern section. At the end of the month wheat, oats, and rye were in good condition, with fine stands as a rule. Pastures were better than usual at this period. Fairly good progress was made in plowing and in other farm work of the season.—*H. C. Bate.*

Texas.—Cool weather prevailed during the greater part of the month. Killing frost occurred frequently over the interior and extended to the coast line on the 25th. Beneficial rains occurred during the month, putting the ground in good condition. Plowing, seeding, and cotton picking were somewhat delayed and unpicked cotton was considerably damaged. Small grains generally did well. Rice thrashing and cane grinding were completed, except in a few localities. Truck gardens were not doing well. Range and stock were in fair condition.—*E. E. Spencer.*

Utah.—Temperatures during the month were abnormally low. Precipitation, which was almost entirely in the form of snow, was deficient over the valleys, but above average in the mountains and more elevated portions of the section. Fall wheat was in very good condition and well protected by an ample covering of snow. Stock, though being fed in many localities, was thriving.—*R. J. Hyatt.*

Virginia.—The general weather conditions of the month were quite favorable for work in the field, as well as for the growth of winter crops. Wheat, oats, and clover did well, on the whole, while rye and barley advanced sufficiently to afford grazing for stock. Considerable plowing was done and much work in the way of gathering, housing, and husking corn was completed. Moderate cold spells caused some light freezing and thawing, but no damage resulted.—*Edward A. Evans.*

Washington.—The fore part of the month was unusually dry, except near the coast, but the last decade was wet, especially in the western section. There was snow at the end of the month throughout the eastern section. The weather was favorable for winter wheat, which was in good condition, although not so well advanced as usual when snow came and covered it at the end of the month.—*G. N. Salisbury.*

West Virginia.—On the whole the weather was exceptionally fine during the month. There were good rains and considerable freezing weather. Stock was in good condition and there was plenty of feed on hand. Early sown wheat was looking well, but late sown was somewhat injured, as there was practically no protection afforded by snow. Little farm work was done.—*E. C. Vose.*

Wisconsin.—The temperature during the month averaged considerably above the normal, although some stations in the northern section reported temperatures ranging from zero to 24° below during the second and third decades. The precipitation, which was a little below the normal, was fairly well distributed. It was generally in the form of snow, which afforded a fair protection to winter grains during the periods of severe cold. No weather conditions of an abnormal character were reported, and the general situation was satisfactory.—*H. B. Hersey.*

Wyoming.—The fall months were unusually favorable for the stock interests of the State, and the close of the year found stock in excellent condition; ranges still afforded good feed, and hay was plentiful. The supply of snow in the mountains was not up to the average for the season, but there was more than at the close of 1904.—*W. S. Palmer.*

SPECIAL ARTICLES.

DOCTOR MARGULES ON THE ENERGY OF STORMS.

By Dr. S. TETSU TAMURA. Dated Washington, December, 1905.

Dr. Max Margules, of Vienna, has enriched theoretical meteorology by an exceedingly suggestive and important memoir on "The energy of storms,"[1] published during 1905, as an appendix to the Yearbook of the Central Meteorological and Geodynamical Institute of Vienna, for the year 1903. The paper consists of two parts. The first part, which covers only four pages, is an excellent summary of his ideas on the energy of storms for the nonmathematical reader. The second part, which covers 22 pages, embodies the elegant mathematical analysis, by which he attained the ideas popularly expounded in the first part.

It may be easily seen that the kinetic energy of a kilogram of air moving with the speed of 30 meters per second is 450 units (kg. m' sec.$^{-2}$) and nearly equal to 0.1 calorie. This quantity, which is not large in comparison with the quantity of heat that a kilogram of air at the earth's surface receives and loses in one day, appears very large when the energy of a kilogram of air moving with the average velocity (say five meters per second) is taken as a unit of measure. It is not probable that a much larger part of the heat communicated to the air at the time of a storm is converted into kinetic energy. Hence there arises the important question, "What is that condition of the atmosphere in which a sufficiently large quantity of kinetic energy can be accumulated in order to produce a storm?"

The first task of Doctor Margules was to construct the *fundamental energy equations of a moving particle and a mass of air in a closed system.* From one of the equations of atmospheric motions relative to moving axes, Doctor Margules formed the following equation[2] of the kinetic energy of a unit mass of air,

$$\frac{d}{dt}\left(\frac{c^2}{2}+W\right)+\frac{1}{\mu}\left(\frac{dp}{dt}-\frac{\partial p}{\partial t}\right)-Rc\cos(R,c)=0. \qquad (1)$$

From this equation, together with the thermodynamic equation,

$$\frac{dQ}{dt}=c_p\frac{dT}{dt}-\frac{1}{\mu}\frac{dp}{dt} \qquad (2)$$

where dQ means an increase of the quantity of heat in a particle of air moving over the distance ds in the time dt, the following energy equation of a moving particle of air is obtained:

$$\frac{dQ}{dt}=c_p\frac{dT}{dt}+\frac{d}{dt}\left(\frac{c^2}{2}+W\right)-\frac{1}{\mu}\frac{\partial p}{\partial t}-Rc\cos(R,c) \qquad (3)$$

for the whole mass for a closed system.

The above equations must be integrated. The equation for kinetic energy thus obtained is

$$\frac{\partial}{\partial t}\int\left(\mu\frac{c^2}{2}+\mu W\right)dk+\int\frac{p}{\mu}\frac{d\mu}{dt}dk-\int Rc\cos(R,c)\,\mu dk=0. \qquad (4)$$

The thermic equation for the entire mass in the closed system becomes

$$\int\frac{dQ}{dt}\mu dk+c_v\frac{\partial}{\partial t}\int T\mu dk-\int\frac{p}{\mu}\frac{d\mu}{dt}dk. \qquad (5)$$

Finally the author obtained the energy equation of the air mass in the closed system as follows:

$$\int\frac{dQ}{dt}\mu dk=c_v\frac{\partial}{\partial t}\int T\mu dk+\frac{\partial}{\partial t}\int\left(\mu\frac{c^2}{2}+\mu W\right)dk-\int Rc\cos(Rc)\mu dk. \qquad (6)$$

[1] Ueber die Energie du Stürme.

[2] The notation is W = the potential due to gravitation and the centrifugal force of the earth's rotation; c the velocity of the air; μ the density; p the pressure; R the resisting force of friction; T the absolute temperature; c_p the specific heat at constant pressure; c_v the specific heat at constant volume; k the volume of the closed system.

These general equations play an important rôle in the course of Doctor Margules's argument. The author adopts the following simplified notations:

$$K = \int \frac{\rho c^2}{2} dk = \text{kinetic energy of the whole mass of air;}$$

$$P = \int \rho W dk = \text{potential energy of position;}$$

$$I = c_v \int T \rho dk = \frac{c_v}{R} \int p dk = \text{internal energy.}$$

For an infinitesimal change of these quantities, δK, δP, δI are used. They are completely determined by their initial and final states. The following quantities depend upon the course of motion:

$$-\delta A = -\int dt \int \frac{p}{\rho} \frac{d\rho}{dt} dk = \text{work of the pressure in time } t;$$

$$-(R) = \int dt \int Rc \cos(Rc) \rho dk = \text{work of the force of friction;}$$

$$(Q) = \int dt \int \frac{dQ}{dt} \rho dk = \text{increase of heat.}$$

By means of these notations the author has thrown the equation of kinetic energy, the thermic equation, and the energy equation into the following simple forms:

$$\delta(K+P+A)+(R)=0$$
$$(Q)=\delta I-\delta A$$
$$(Q)=\delta(K+P+I)+(R).$$

The motions of the atmosphere are conditioned by the importation of heat, but it may be possible that for certain great atmospheric motions the importation of heat is inappreciable. In such motions the initial and final states alone determine δA the work done by the pressure. It is also known that when the air mass is kept at constant temperature, or when every small particle of air mass behaves adiabatically, the quantity A takes the meaning of potential energy. The next condition is $(Q) = 0$, whence the author derives the energy equation as follows:

$$\delta K + (R) = -\delta(P + I).$$

With this equation Doctor Margules attempts, in the following chapters, to solve the problem of a closed system of dry air that without importation of heat can develop as much kinetic energy as we observe in storms. The mass of air in the closed system is supposed to possess a given temperature and pressure distribution and to be at rest in the beginning. It is put in motion and endeavors to establish a stable equilibrium. If there be no friction, the particles of air will oscillate and thus reach the position of equilibrium. If there be friction, a final state is reached in which kinetic energy is gradually consumed. Doctor Margules seeks for the greatest value of $\delta K + (R)$, which may be called the available kinetic energy of the system.

The author devotes the second chapter to the discussion of the simplest cases of the problem, namely: The application of the energy equation to the interchange of strata in an air column. As the first example, Doctor Margules calculates the available kinetic energy due to the change of the position of a stratum of air for two different conditions, that is to say, where there is a continuous temperature distribution and when there is a discontinuous temperature distribution. Then the author simplifies the condition of stable equilibrium by introducing the idea of entropy and of von Bezold's potential temperature, since equilibrium is stable, if the strata with higher potential temperature or with greater entropy lie above those of lower potential temperature or of smaller entropy. Next, the displacement of a particle of air that has a different temperature from that of the surrounding particles is incidentally considered. The rest of the chapter is given to the discussion of the fall of higher strata in an air column. In this case two strata of air lie initially one above the other in indifferent equilibrium, the entropy of the lower stratum being greater than that of the higher one. If the air mass is put in motion, then the strata will interchange their positions and Doctor Margules calculates the quantity of the available kinetic energy due to such an action.

In the third chapter the author gives an elaborate calculation of the kinetic energy of a mass of air which passes over adiabatically from a given initial state to a state of equilibrium. The problem first considered in this connection is the following: In the lower part of a closed system the two masses of air are at the beginning separated by a vertical wall, and the entropy of the air mass in the first section is smaller than that of the air mass in the second section. Now, what amount of kinetic energy becomes available when we remove the wall of separation and allow the two masses of air to pass adiabatically to the state of equilibrium? The problem is analogous to one already considered in the previous chapter. Next, Doctor Margules submits an approximate analysis of the case in which the two masses of air are respectively in stable equilibrium, but the entropy of a kilogram of the cold air of the higher layer is in the beginning smaller than that of the warm air of the ground layer. In the final state the whole mass of cold air spreads out below with the warm air above it. The rest of the chapter is devoted to the discussion of the available kinetic energy in the case of a continuous horizontal temperature distribution, when the vertical temperature distribution is such as to produce indifferent equilibrium. The chapter concludes with a comparison of these calculations with those for incompressible fluids.

Thus far Margules has paid attention to the consideration of the *dry air* only; but in the fourth chapter he enters on the discussion of the condensation of the moisture in a mass of air that changes its position, and of the influence of the heat of condensation upon the energy of a storm. It is evident that the energy equation

$$(Q) = \delta(K + P + I) + (R)$$

is applicable to a complex atmosphere of air, water, and vapor as well as to dry air. In this connection the author considers particularly the following two special cases: In chamber No. 1 the dry air is in indifferent equilibrium, and in chamber No. 2 separated from No. 1 by a vertical wall, the moist air, which is assumed here to possess the property of expanding only with an increase of heat but otherwise of behaving like dry air, and to be in indifferent equilibrium. After the removal of the partition between the chambers, the dry air in chamber No. 1 will spread itself out at the bottom with the moist air above it. The same results would be attained when stable equilibrium prevails initially in each chamber. To this case the energy equation may be applied in the form

$$\delta K + (R) = (Q) - \delta(P + I)$$

where Q is the heat added by the condensation due to expansion.

The air in chamber No. 2 cools by expansion less than the dry air in chamber No. 1. Therefore it affords only a small addition to $\delta(P + I)$. The difference between the two is exactly compensated by the flow of heat. Hence Margules concludes that the heat of condensation contributes nothing to the energy of the storm.

In his mathematical analysis and calculations the author has first made the following various assumptions: (1) that the mass of air forms a closed system, (2) that there is a sharp boundary between the cold and warm air, and (3) that there exist level surfaces of equal pressure. At first sight these assumptions appear to be too artificial, but they are made in order to solve the problem mathematically.

According to Doctor Margules, the kinetic energy of a mass of air is due to its internal energy and the work of gravity.

The potential energy of position is the source of the energy of the storm. It is shown in his analysis that a system in which the mass of air is brought down vertically from equilibrium can contain the required energy. Of the various kinds of storms, the *boeëns* that occur with a rapid rise of pressure and a rapid fall of temperature, and the tornadoes that, according to W. M. Davis, originate in the neighborhood of the boundary of cold and warm air masses, appear best to conform to the analysis and calculations of Doctor Margules.

The phenomena of atmospheric motion in the great storm fields which we call cyclones are less penetrating than in the *boeën*. These occur in the middle and high latitudes and appear to originate from the interaction of cold and warm air masses which lie horizontally contiguous. But afterwards in equilibrium the cold air spreads out in the lower strata. The author points out that it is not impossible that these great storms are created from the potential energy of a similar initial condition. Doctor Margules seems to disprove the condensation theory of storms advanced by Espy, Ferrel, and Oberbeck, but agrees with Professor Bigelow's idea that the cyclone does not originate from the energy of the latent heat of condensation, but that the energy of storms develops from the interchange of location of masses of air of unequal temperatures.

Doctor Margules' analysis and calculations, however, give only a general idea of the source of storm energy. A satisfactory model of the cyclone with asymmetrical distribution of temperature has not yet been constructed. Moreover, the peculiar conditions in the field of the tropical hurricane in which there does not usually occur any great temperature difference on the ground and where the cyclonic distribution of temperature reaches only to the height of a few kilometers, also need another investigation.

AIR AND WATER TEMPERATURES.

By W. F. COOPER, Michigan Geological Survey. Dated Lansing, Mich., December 16, 1905.

(1) LOWER MICHIGAN.

An examination of the yearly mean isothermal lines for lower Michigan, as given in the reports of the Michigan Section of the Climate and Crop Service of the U. S. Weather Bureau in cooperation with the Michigan State Weather Service, affords some suggestive comparisons. We have, for instance, prepared Table 1, showing the higher latitude of the annual isothermal lines on the west shore of lower Michigan as compared with the east shore for the years 1900–1904, inclusive.

TABLE 1.

Year.	Temperature.	Miles farther north on west shore of the lower peninsula.	Year	Temperature.	Miles farther north on west shore of the lower peninsula.
	° F.			° F.	
1900	48	10	1903	46	108
	46	20		44	66
1901	46	31		44	54
	44	60		43	30
1902	48	1	1904	42	42
	46	52		41	78
	44	60		40	40

From these data we see that the isotherm of 48° has been an average distance of 6 miles farther north on the west shore than on the east; that of 46°, 53 miles; of 44°, 60 miles; of 42° and 40° for the year 1904, 43 and 40 miles, respectively. An average of these combined data shows the same temperature averages extending 46 miles farther northward on the west side of the lower peninsula of Michigan.

As an exception to this general rule of higher isothermal lines on the western shore of lower Michigan, the isotherm of 48° for 1903 is eight miles farther north in Macomb County, adjacent to Lake St. Clair, than it is where Van Buren County is washed by the waters of Lake Michigan. Likewise during 1904 the line for 45° is sixteen miles farther south in Berrien County than in Macomb. Both these isothermals, however, show some deflection to the northward on approaching Lake Michigan.

(2) LAKE MICHIGAN.

Comparing the isothermals on the east and west sides of Lake Michigan, as given in the reports of the section directors of Michigan and Wisconsin, we obtain the following results:

TABLE 2.

Year.	Temperature.	Miles farther south on the east side.	Miles farther north on the east side.	Year.	Temperature.	Miles farther south on the east side.	Miles farther north on the east side.
	° F.				° F.		
1900	48	5	.....	1902	46	.....	50
	46	.....	38	1903	46	.....	100
	42	.....	25		44	.....	88
1901	48	23	.....	1904	44	4	.....
	46	.....	16		42	.....	33
1902	48	26	.....				

Taking into account the negative figures in this comparison, the results show the average temperature on the east side of the lake 36 miles farther north than on the east coast of Wisconsin.

(3) SPECIAL OBSERVATIONS AND THEORY.

The object of this paper is to present some data showing the cause of this distribution of temperature. In obtaining the temperature observations thermometer No. 7529 by H. J. Green was used. The readings of the temperatures of the air over the land and of the water in the bay were taken on the west side of Saginaw Bay and east of Tobico Inlet, northwest of Bay City. Less than five minutes elapsed between the readings in the air over the land, and in the water. During August 12, 13, 15, 16, 17, and 18, 1904, the thermometer was read at 5:30 a. m. and hourly from 7:30 a. m. to 10:30 a. m., and 11:15 a. m., and hourly from 1:00 p. m. to 7:00 p. m., excepting at 6:00 p. m. August 22 and 23 readings were taken consecutively from 1:00 p. m. to 11:15 a. m. the following forenoon. August 25 and 26 the thermometer was read from 5:30 a. m. to 5:30 a. m., being consecutive for 24 hours ending August 26. The full record is given in Table 12. Judging from the last two series of observations the maximum and minimum temperatures were very nearly obtained by the readings taken from 5:30 a. m. to 7:00 p. m. These temperatures of air and water at Tobico will now be compared with the minimum and maximum readings taken by the cooperative observers of the Weather Bureau at Bay City, Midland, Saginaw (west side), and Hayes. Bay City is situated six miles southeast from Tobico, Midland sixteen miles west and somewhat south, Saginaw nineteen miles almost due south, Hayes thirty-six miles east-northeast across Saginaw Bay. These readings can be most conveniently presented in tables.

TABLE 3.—*Maximum and minimum temperatures, August 12, 1904.*

Location.	Maximum.	Minimum.	Range.
	°	°	°
Tobico, Saginaw Bay	73.5	68	5.5
Tobico, air	79	51	28
Bay City	80	48	32
Midland	80	58	22
Saginaw	80	48	32
Hayes	78	44	34

The range of water temperature at Tobico compared with the range of the air temperature is 19 per cent. The winds were light and variable. The average of the air temperatures on the day in question was 71°, of the water 72°.

TABLE 4.—*Maximum and minimum temperatures, August 13, 1904.*

Location.	Maximum.	Minimum.	Range.
	°	°	°
Tobico, Saginaw Bay	71 +	68.	3 +
Tobico, air	80. 5	66.	14. 5
Bay City	77	47	30
Midland	78	58	20
Saginaw	87	63	24
Hayes	82	61	21

The day was cloudy until 9:30 a. m. The readings closed at 11:15 a. m. The air temperature at Tobico increased 14.5°; that of the bay 3° or 20.7 per cent. The average of six readings taken during the forenoon was 71.6° for the air and 68.9° for the water. The wind at Saginaw and Midland was from the southwest; at Bay City from the north.

TABLE 5.—*Maximum and minimum temperatures, August 15, 1904.*

Location.	Maximum.	Minimum.	Range.
	°	°	°
Tobico, Saginaw Bay	74	67	7
Tobico, air	84	62	22
Bay City	86	63	23
Midland	76	52	24
Saginaw	89	66	23
Hayes	86	59	27

The day was clear with westerly winds blowing. From 5:30 a. m. to 2 p. m. the range of the water temperature was 33 per cent of the range of the air temperature at Tobico. Locally the result in moderating the temperature at Tobico is somewhat apparent, but we would rather expect the ratio of the ranges of temperature at Midland and Hayes to be reversed.

TABLE 6.—*Maximum and minimum temperatures, August 16, 1904.*

Location.	Maximum.	Minimum.	Range.
	°	°	°
Tobico, Saginaw Bay	77	69	8
Tobico, air	79.7	62.0	17.7
Bay City	81	60	21
Midland	70	50	20
Saginaw	83	61	22
Hayes	78	56	22

It rained during the night of August 15 and 16, clearing up by noon time. The wind was down the bay, or from the northeast during the period of fair weather. At Bay City, Midland, and Hayes the wind was from the northwest; at Saginaw from the southwest. The water temperature range was 45 per cent of the range of the air temperature. This very considerably higher ratio of the water temperature is very probably due to the action of the wind sweeping down the bay, thereby exposing a relatively larger water surface to the wind within a unit of area, and to the action of the waves in entrapping particles of air. Not having the temperature of the rain water which fell during the night it is impossible to state how this would modify that of the water in the bay. The water temperature only dropped 3° from 7 p. m. to 5:30 a. m. the next morning, while that of the air fell 9° in the same interval. It is apparent that under such conditions we would have the climate somewhat modified, the main tendency being to check sudden changes near the adjacent windward shore and to increase the differences of temperature between the water and the air, especially at night. With the exception of Midland, the air temperatures increase with distance from the bay. The highest minimum temperature is found adjacent to the shore as we should expect; away from the water it oscillates irregularly as can be seen from the tables. The average air temperature at Tobico was 71.25°, of the water 73.07°.

TABLE 7.—*Maximum and minimum temperatures, August 17, 1904.*

Location.	Maximum.	Minimum.	Range.
	°	°	°
Tobico, Saginaw Bay	77	71	6
Tobico, air	80	62	18
Bay City	75	60	15
Midland	74	50	24
Saginaw	82	60	22
Hayes			

The day was clear with the wind at Tobico from the west during the greater part of the forenoon, shifting to the north at 1 p. m. At Bay City the wind was from the northwest, at Saginaw from the southwest, and at Midland from the west. The range of the water temperature was 33 per cent of the range of the air temperatures at Tobico, being intermediate between periods when the wind is off and on shore. The main trend of the bay is northeast. It is apparent that this northerly wind decidedly influenced the temperature of Bay City which is situated directly south of the bay about two miles. It is also noticeable that Saginaw was benefited to a considerably less extent, being some fourteen miles farther south, and the effect of the lake breeze is much less apparent. The still greater range at Midland is apparently explained by its location and the westerly breeze blowing there. These on shore winds are only effective in modifying climatic conditions within relatively circumscribed areas. This deduction is not only borne out in part by our own data, but also by an examination of the isothermal charts of lower Michigan for 1900–1904, inclusive, to which we have already had occasion to refer. An average of twelve air and water temperatures gives 72.8° for the former and 73.9° for the latter at the stations near Tobico. It is also believed that an examination of the observations for August 17, and other sources of information, show that insular exposures are more decidedly influenced by the climatic factors that tend to prevent low minimum temperatures, than by those tending to modify the maxima. This is especially true in the late summer and fall. In the spring and early summer we should expect the reverse. As to the former conclusion, as we shall see further on, this is due to the very considerable capacity water has for absorbing heat during the day and retaining it at night.

TABLE 8.—*Maximum and minimum temperatures, August 18, 1904.*

Location.	Maximum.	Minimum.	Range.
	°	°	°
Tobico, Saginaw Bay	75. 3	66. 0	9. 3
Tobico, air	75. 2	57. 0	18. 2
Bay City	75	58	17
Midland	78	60	18
Saginaw	78	59	19
Hayes	80	45	35

During the day the sky was clear with an easterly wind blowing on shore at Tobico; at Bay City and Saginaw the wind was from the northeast; at Midland from the northwest. The records of the cooperative observer of the Weather Bureau at Hayes are wanting as to the wind. The temperature range of the water in Saginaw Bay was 50 per cent of the temperature range of the air over the land. Comparing this date with those previously discussed, it was noted that with a north wind blowing diagonally across the bay, the ratio of water temperature range to air temperature range was 33 per cent; with a northeasterly wind blowing down the bay, 45 per cent; and with an east wind, 50 per cent. While,

theoretically, we might expect the greatest increase of water temperature with a full breeze coming from the northeast down the main axis of the bay, this result is very probably modified by the shallow waters of the lower reaches of Saginaw Bay, giving greater play to wave action. However, the same effect would very likely occur with a cold wave from the west. This on shore action, as noted above, is not only pronounced in increasing the relatively greater warmth of the water, but also in modifying proportionately that of the adjacent air to the west. It is also true that this modification of relative temperature would be greater during the night on account of the greater radiation of the heat from the land. The temperature at Hayes compared with that at Midland shows a greater range of temperature at the former place, probably due to this easterly wind.

TABLE 9.—*Maximum and minimum temperatures, August 22–3, 1904.*

Location.	Maximum.	Minimum.	Hayes.
	°	°	°
Tobico, Saginaw Bay	74.5	66.0	8.5
Tobico, air	76	50	26
Bay City	75	45	30
Midland	78	58	20
Saginaw	78	44	34
Hayes	83	45	38

During portions of these two days observations were taken consecutively from 1:00 p. m. to 11:15 a. m.

Our maximum readings were taken August 22; minimum readings the following morning. The weather was clear, wind from the northwest, shifting to the west at about 7 a. m., August 23. At Bay City and Midland the wind blew from the southeast and south; at Saginaw from the southwest. During this time the range of water temperature, compared with that of the air, was 32.6 per cent. During the forenoon of the 23d the air temperature increased 24° by 11:15 a. m., and the water temperature increased 5.7° within the same time, or 23.75 per cent of the range on land. While during the afternoon the maximum air temperature was 1.8° greater than the water, at 5:30 a. m. the next morning the lowest air temperature was 16° lower than the minimum water temperature, showing the very considerable capacity of the water to retain heat during the night, and the action that it would have on the air temperature over the land with an on-shore wind blowing. The averages of our air and water temperatures near Tobico are, respectively, 64.5° and 69.9° during the entire period of about 24 hours.

TABLE 10.—*Maximum and minimum temperatures, August 25–6, 1904.*

Location.	Maximum.	Minimum.	Range.
	°	°	°
Tobico, Saginaw Bay	75.5	63.3	12.2
Tobico, air	85	46	39
Bay City	83	44	39
Midland	80	60	20
Saginaw	82	43	39
Hayes	80	(?)	(?)

During the 24 hours ending at 5:30 a. m., August 26, 1904, we have a continuous series of observations of air and water temperatures. At Tobico the weather was fair, with quite a strong westerly wind blowing throughout that time. At Bay City, Midland, Saginaw, and presumably at Hayes, the wind was also from the west and southwest. Our maximum readings were taken on the 25th; minimum on the 26th. The average of eighteen readings gives an air temperature of 67.07°, that of the water being 69.9° for the same time. During the 25th the land and water temperatures increased 13° and 7.5°, respectively, the ratio of the ranges being 57.6 per cent, followed by a drop of 39° and 12.2° of the air and water temperatures, respectively, by 5 a. m. on the 26th, or only 31 per cent of change of the water temperature relative to the change of the air temperature. Air and water temperatures taken simultaneously on the other side of the bay would be desirable for comparison here. These readings, however, clearly show the property water has of absorbing and retaining heat to a great extent.

Tables 11 and 12 show the maximum and minimum temperatures for Saginaw, Bay City, and Midland, as furnished by Mr. C. F. Schneider, Section Director, Grand Rapids, Mich., as also our own observations near Tobico.

TABLE 11.

Station.	1904. Aug. 12. Max.	Aug. 12. Min.	Aug. 13. Max.	Aug. 13. Min.	Aug. 15. Max.	Aug. 15. Min.	Aug. 16. Max.	Aug. 16. Min.	Aug. 17. Max.	Aug. 17. Min.
	°	°	°	°	°	°	°	°	°	°
Tobico, Saginaw Bay	73.5	68	71 +	68	74	67	77	69	77	71
Tobico, air	79	51	80.5+	66	83	62	79.7	62	80	62
Bay City	80	48	77	47	86	63	81	60	75	60
Midland	80	58	78	58	76	52	70	50	74	50
Saginaw	80	48	87	63	89	66	83	61	82	60
Hayes	78	44	82	61	86	59	78	56	.....	.....

tation.	1904. Aug. 18. Max.	Aug. 18. Min.	Aug. 22. Max.	Aug. 22. Min.	Aug. 23. Max.	Aug. 23. Min.	Aug. 25. Max.	Aug. 25. Min.	Aug. 26. Max.	Aug. 26. Min.
	°	°	°	°	°	°	°	°	°	°
Tobico, Saginaw Bay	75.3	66	74.5	.....	.....	66	75.5	.....	.....	63.3
Tobico, air	75.2	57	76	.....	.....	50	85	.....	.....	46
Bay City	75	58	75	.....	.....	45	83	.....	.....	44
Midland	78	60	78	.....	.....	58	80	.....	.....	60
Saginaw	78	59	78	.....	.....	44	82	.....	.....	43
Hayes	80	45	83	.....	.....	45	80	.....	.....	.....

In the interval of time covered by these observations the average water temperature was 72.11°, that of the air 72.38°. It is more probable, however, as shown by our readings for 24 hours, that the average water temperature is about 4° greater during the latter part of August than that of the air. The ratio of change of water temperature relative to that of the air temperature is less than 34.4 per cent. In this factor, taking into account the prevailing southwesterly winds, we find a partial explanation of the insular

TABLE 12.—*Air and water temperatures at Tobico, near Bay City.*

Hour.	1904. Aug. 12. Tobico, air.	Aug. 12. Tobico, Saginaw Bay.	Aug. 13. Tobico, air.	Aug. 13. Tobico, Saginaw Bay.	Aug. 15. Tobico, air.	Aug. 15. Tobico, Saginaw Bay.	Aug. 16. Tobico, air.	Aug. 16. Tobico, Saginaw Bay.	Aug. 17. Tobico, air.	Aug. 17. Tobico, Saginaw Bay.
	°	°	°	°	°	°	°	°	°	°
1:00 a. m.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
3:00 a. m.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
5:00 a. m.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
5:30 a. m.	51	68	66	68	62	67	62	69	62	71
7:30 a. m.	64.5	69	69.3	68.3	66.2	68.6	65	69	67.4	71.3
8:30 a. m.	.....	.....	69	68.5	71	71	62	69.3	72.5	72.5
9:30 a. m.	72.5	71	71.4	69	73.5	73	66.3	70.3	76.2	73.6
10:30 a. m.	.....	.....	73.5	.....	73.5	73	68.2	71	78	75
11:15 a. m.	74	73.5	80.5	71	73.3	73.3	72.7	72	80	76
1:00 p. m.	78	73.6	.....	.....	83	74	79.7	75.6	79	77
2:00 p. m.	78	73.3	.....	.....	81.6	74	76.2	76.5	78.6	76
3:00 p. m.	79	73.5	.....	.....	.....	.....	76.3	77	74.8	75.5
4:00 p. m.	78	73.5	.....	.....	79	74	76.6	76.5	72	74.3
5:00 p. m.	76	73.5	.....	.....	84	73.3	79	76.5	68.2	73.2
6:45–7:00 p. m.	71	71.6	.....	.....	71.5	73	71	74.1	65	71.1
9:00 p. m.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
11:00 p. m.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Average	71	72	71.6	68.9	74.4	72.2	71.25	73.07	72.8	73.9

TABLE 12.—*Air and water temperatures at Tobico, near Bay City*—Cont'd.

Hour.	1904. Aug. 18. Tobico, air.	Aug. 18. Tobico, Saginaw Bay.	Aug. 22. Tobico, air.	Aug. 22. Tobico, Saginaw Bay.	Aug. 23. Tobico, air.	Aug. 23. Tobico, Saginaw Bay.	Aug. 25. Tobico, air.	Aug. 25. Tobico, Saginaw Bay.	Aug. 26. Tobico, air.	Aug. 26. Tobico, Saginaw Bay.
	°	°	°	°	°	°	°	°	°	°
1:00 a. m.	.....	.....	.....	.....	53	67.3	.....	.....	48	65
3:00 a. m.	.....	.....	.....	.....	51	66.5	.....	.....	46	64
5:00 a. m.	.....	.....	.....	.....	.....	.....	.....	.....	46	63.3
5:30 a. m.	57	66	.....	.....	50	66	72	68	46.5	64
7:30 a. m.	65.4	68	.....	.....	61	67	76	70	.....	.....
8:30 a. m.	65.5	68.6	.....	.....	69	68	79	71.5	.....	.....
9:30 a. m.	70.5	69.8	.....	.....	69.5	69	79	72.5	.....	.....
10:30 a. m.	69.3	72.2	.....	.....	72.5	70.4	79	72.5	.....	.....
11:15 a. m.	75.2	74	.....	.....	74	71.7	80.5	73.4	.....	.....
1:00 p. m.	73.3	74.8	73	73.2	.....	.....	85	75.3	.....	.....
2:00 p. m.	73.4	75.3	75.5	74.5	.....	.....	79	75.1	.....	.....
3:00 p. m.	73	75	76	74.2	.....	.....	78.2	75.5	.....	.....
4:00 p. m.	73	74.1	74.2	73.6	.....	.....	74.1	74.5	.....	.....
5:00 p. m.	72	73	72.6	72.6	.....	.....	70.5	73.5	.....	.....
6:45–7:00 p. m.	68	71	62.6	71	.....	.....	63	69	.....	.....
9:00 p. m.	.....	.....	59	69	.....	.....	55	66.5	.....	.....
11:00 p. m.	.....	.....	55	68	.....	.....	50.5	66	.....	.....
Average	69.7	71.8	.....	.....	*64.5	*69.9	.....	.....	*67.07	*69.9

* Average of the 24-hour period ending with the last observation of this date.

climate of lower Michigan. Moreover, the temperature of the water, as a rule, being greater than that of the air from about 7 p. m. until about 9 a. m. the day following, the tendency would be to increase the temperature of the adjacent shores. On the other hand, the air temperature being greater during the remainder of the day, the water would tend to establish an equilibrium by reducing the air temperature, the mean range probably approaching a mean of the average ranges of air and water temperatures. The more prolonged period of higher water temperature is doubtless the greater factor in this question.

INTERNATIONAL METEOROLOGICAL DEFINITIONS AND SYMBOLS.

Compiled by E. R. MILLER. Dated Washington, D. C., January 1, 1906.

Progress in meteorology, both practical and theoretical, depends, more than in the case of other sciences, upon international uniformity in methods of observing, recording, and publishing data. Such uniformity may be secured by adherence to the recommendations of the international meteorological congresses, conferences, and committees. The reports of the meetings of these organizations have been published in the principal European languages, including English, and the resolutions and recommendations of the various conferences from 1872 to 1891 were codified and published by Prof. H. Wild, of St. Petersburg, in his Repertorium für Meteorologie, Band XVI, No. 10, 1893.

The nomenclature, definitions, and classification of clouds recommended by the International Meteorological Committee in 1894, was made the official system of the United States Weather Bureau in 1895.

The international meteorological symbols were devised by the permanent committee appointed by the International Meteorological Congress that met in Vienna in September, 1873. A few additional symbols have been adopted and the official definitions have been modified at the meetings held at Munich in 1892, at Paris in 1896, and at Innsbruck in 1905. With the exception of the thunderstorm symbol (⛈) they have not been adopted by the United States Weather Bureau for use by its regular observers, but were recommended for use by the cooperative observers in a circular issued by the Chief Signal Officer in 1883, and again by the Chief of the Weather Bureau in a circular dated January 1, 1894. They were introduced for the first time into the tables of data published in the Annual Report of the Chief of the Weather Bureau in the volume for 1903–04.

The circular of January 1, 1894, unfortunately contained several typographical errors, which also crept into the subsequent reprints of that circular in the Smithsonian Meteorological Tables, edition of 1897, in the MONTHLY WEATHER REVIEW for July, 1898, page 311, and in the Classification of Clouds and International Meteorological Symbols recently published by the Weather Bureau.

It is with a view to presenting a complete and accurate statement to American observers that the following revision has been prepared.

We are indebted to Mr. A. L. Rotch, American member of the International Cloud Committee and Director of the Blue Hill Observatory, and Messrs. H. H. Clayton and S. P. Ferguson, of the Blue Hill Observatory staff, for valuable criticisms and the notes accompanying this article.

CLASSIFICATION OF CLOUDS.

Upper clouds.—Cirrus (*a*). Cirro-stratus (*b*).

Intermediate clouds.—Cirro-cumulus (*a*). Alto-cumulus (*a*). Alto-stratus (*b*).

Lower clouds.—Strato-cumulus (*a*). Nimbus (*b*).

Clouds formed by diurnal ascending currents.—Cumulus. Cumulo-nimbus.

High fogs.—Stratus.

The clouds marked (*a*) usually occur in separate or rounded masses and are most frequently seen in dry weather. Those marked (*b*) are forms which are widely extended or completely cover the sky, as in wet weather.

HEIGHTS OF CLOUDS.

In the following table[1] are given the mean heights of clouds as determined by observations during the "cloud year" 1896–97, except in the case of Allahabad, where the observations were made from December, 1898, to March, 1900:

Mean heights of clouds.

SUMMER.

Kind of clouds.	Upsala, Sweden.	Pavlovsk, Russia.	Potsdam, Germany.	Trappes, France.	Toronto, Canada.	Blue Hill, Mass.	Washington, D. C.	Allahabad, India.	Manila, P. I.
	m.	m.	m.	m.	m.	m.	m.	m.	m.
Cirrus	8,176	8,814	9,054	8,936	10,901	9,525	10,358	10,765	11,133
Cirro-stratus	6,362	8,094	8,085	7,851	8,943	10,099	10,620	.....	12,968
Cirro-cumulus	6,457	4,600	5,893	5,826	8,883	6,673	8,826	11,278	6,823
Alto-stratus	2,774	.....	3,293	3,792	4,241	6,247	5,772	.....	4,302
Alto-cumulus	3,432	3,053	3,632	3,676	3,516	3,763	5,030	4,502	5,707
Strato-cumulus	1,771	1,847	2,163	1,815	2,005	1,160	2,870	.....	1,901
Nimbus	1,197	.....	1,792	1,079	.....	1,189	1,926	836	1,382
Cumulus	1,685	1,764	1,880	1,574	1,697	.....	.....	1,757	1,826
Cumulus (summit)	2,000	2,406	2,100	2,160	.....	2,900	3,068	.....	.....
Cumulus (base)	1,454	1,635	1,445	.....	.....	1,781	1,182	.....	.....
Fracto-cumulus	1,832	2,146	1,707	1,402	.....	.....	.....	.....	.....
Cumulo-nimbus	.....	.....	.....	.....	.....	.....	.....	1,714	6,454
Cumulo-nimbus (summit)	3,971	4,682	3,990	3,485	.....	9,031	4,965	.....	.....
Cumulo-nimbus (base)	.....	1,615	2,057	2,525	.....	1,601	1,750	.....	.....
Stratus	.....	839	675	944	.....	510	838	.....	1,065

WINTER.

Cirrus	6,980	8,740	8,070	8,514	9,978	8,612	9,511	12,884	10,634
Cirro-stratus	5,455	7,090	7,653	5,849	8,530	8,893	9,526	13,342	11,638
Cirro-cumulus	6,131	5,985	5,406	5,634	8,246	6,155	7,413	11,553	6,421
Alto-stratus	4,090	.....	2,988	3,822	4,180	4,574	4,801	.....	.....
Alto-cumulus	4,114	3,172	3,349	4,274	2,494	3,658	3,822	6,257	4,638
Strato-cumulus	1,964	1,501	1,415	1,614	1,542	1,604	2,399	3,550	2,322
Nimbus	987	.....	1,285	1,053	.....	646	1,804	5,003	1,488
Cumulus	1,516	.....	1,499	1,112	1,326	.....	.....	1,344	1,821
Cumulus (summit)	1,649	1,602	1,744	2,371	.....	1,623	2,855	.....	.....
Cumulus (base)	714	1,118	991	.....	.....	1,544	1,198	.....	.....
Fracto-cumulus	1,219	.....	1,025	1,429	.....	.....	.....	2,619	.....
Cumulo-nimbus	.....	.....	.....	.....	.....	.....	.....	2,521	3,136
Cumulo-nimbus (summit)	5,175	.....	4,735	3,850	.....	.....	3,730	.....	.....
Cumulo-nimbus (base)	1,377	.....	3,825	.....	.....	.....	.....	.....	.....
Stratus	506	1,600	607	.....	.....	608	1,132	.....	.....

An inspection of the table will suffice to establish the validity of the following rules:

[1] Rapport sur les observations internationales des nuages au Comité International Météorologique par H. Hildebrand Hildebrandsson. Part II, 1905, Table I, page 2.

1. The heights of clouds, especially upper clouds, decrease from the equator toward the poles.

2. The heights of clouds are greater in summer than in winter in the temperate zones. In India they are, in general, higher during the northeast monsoon than during the southwest monsoon.

DESCRIPTION OF CLOUDS.[2]

The following descriptions are quoted from the English text of the International Cloud Atlas, Paris, 1896, with some modifications to make them agree with the French and German texts, and other modifications adopted by the conference at Innsbruck in September, 1905, and which will appear in the new edition of the cloud atlas.

Cirrus (*Ci*.[3]).—Detached clouds, delicate and fibrous looking, taking the form of feathers, generally of a white color, sometimes arranged in belts which cross a portion of the sky in "great circles," and, by an effect of perspective, converge toward opposite points of the horizon; the Ci.-St. and the Ci.-Cu. often contribute to the formation of these belts.

Cirro-stratus (*Ci.-St.*[4]).—A thin, whitish sheet; at times completely covering the sky and giving it a whitish appearance, when it is sometimes called cirro-nebula, or at other times presenting, more or less distinctly, a formation like a tangled web. This sheet often produces halos around the sun and moon.

Cirro-cumulus (*Ci.-Cu.*).—Small globular masses or white flakes without shadows, or having very slight shadows, arranged in groups and often in lines.

Alto-cumulus (*A.-Cu.*).—Rather large globular masses, white or grayish, partially shaded, arranged in groups or lines, and often so closely packed that their edges appear confused. The detached masses are generally larger and more compact (changing to St.-Cu.) at the center of the group; at the margin they form into finer flakes (changing to Ci.-Cu.). They are often spread out in lines in one or two directions.

Alto-stratus (*A.-St.*[4]).—A thick sheet of gray or bluish color, showing a brilliant patch in the neighborhood of the sun or moon, and which, without causing halos, may give rise to coronæ. This form goes through changes like those of the cirro-stratus, but its altitude is one-half as great.

Strato-cumulus (*St.*[4]*-Cu.*).—Large globular masses or rolls of dark cloud, frequently covering the whole sky, especially in winter, and occasionally giving it a wavy appearance. The layer of strato-cumulus is not, as a rule, very thick, and patches of blue sky are often visible through the intervening spaces. All sorts of transitions between this form and the alto-cumulus are noticeable. It may be distinguished from nimbus by its globular or rolled appearance, and also because it does not bring rain.

Nimbus (*Nb.*[4]). *Rain cloud.*—A thick layer of dark clouds, without shape and with ragged edges from which continued rain or snow generally falls. Through the openings in these clouds an upper layer of cirro-stratus or alto-stratus may almost invariably be seen. If the layer of nimbus separates into shreds, or if small, loose clouds are visible floating at a low level, underneath a large nimbus, they may be described as fracto-nimbus. (Fr.-Nb.) (The "Scud" of sailors.)

Cumulus (*Cu.*[5]). *Woolpack clouds.*—Thick clouds of which the upper surface is dome-shaped and exhibits protuberances while the base is horizontal. These clouds appear to be formed by a diurnal ascensional movement, which is almost always observable. When the cloud is opposite the sun, the surfaces presented to the observer have a greater brilliance than the margins of the protuberances. When the light falls aslant, these clouds show deep shadows; when these clouds are on the same side as the sun they appear dark, with bright edges.

The true cumulus has definite superior and inferior limits. It is often broken up by strong winds, and the detached portions undergo continual changes. These portions are distinguished by the name of fracto-cumulus, (Fr.-Cu.).

Cumulo-nimbus (*Cu.-Nb.*[4]). *Thundercloud, shower-cloud.*—Large masses of clouds, rising in the form of mountains, turrets, or anvils, generally having a sheet or screen of fibrous appearance above ("false cirrus"[6]) and a mass of cloud similar to nimbus underneath. From the base there usually fall local showers of rain or of snow (occasionally hail or sleet). Sometimes the upper edges have the compact cumulus form, forming into massive peaks round which the delicate "false cirrus" floats, and sometimes the edges themselves separate into a fringe of filaments similar to that of the cirrus cloud. This last form is particularly common in spring showers.

The front of a thundercloud of wide extent frequently presents the form of a large arch spread above a portion of the sky which is uniformly brighter in color.

Stratus (*St.*[4]).—A uniform sheet of cloud, analogous to fog, but not touching the ground. The complete absence of detail distinguishes stratus from the compact sheets formed by other clouds. When this sheet is broken up into irregular shreds by the wind, or by the summits of mountains, it may be distinguished by the name of fracto-stratus. (Fr.-St.)

INTERNATIONAL METEOROLOGICAL SYMBOLS.[7]

The international symbols were devised for the sake of brevity, and to provide characters independent of language to represent the word or words used in any language to designate the respective phenomena.

These symbols are convenient for use in manuscript records and are now almost universally employed in the publications of the various national weather services; consequently all American observers should be familiar with them.

In any publication defining the use of these symbols the official definitions by the international meteorological congresses and committees should appear first without modification. Any additional explanation for the benefit of students and observers should be supplementary, and should be kept separate.

It is suggested that in the publication of climatological data the symbols appear in tabular form, as shown below (this plan having been adopted by many institutions), and that the arrangement of the text relative to the symbols be as follows:

1. Title.

---

[2] In order to secure complete uniformity in the observations the conference at Innsbruck requested authors of meteorological treatises or instructions to reproduce *verbatim* the definitions of the International Cloud Atlas without additions or changes.

[3] It is recommended by the conference that the abbreviated name of the cloud observed be underlined when the form is typical, e. g., *A.-Cu*, and that the kind of cloud from which rain falls be noted.

[4] It is recommended by the conference that nimbus be abbreviated to Nb. and stratus to St. in order to avoid confusion with the abbreviation N=north, and S=south.

[5] The form assumed by certain clouds, particularly during the sirocco, mistral, or foehn, i. e., that of an ovoid with sharp edges, and sometimes iridescent, is called lenticularis, e. g., cumulus lenticularis. During the summer all low clouds, as a rule, assume special forms resembling more or less the cumulus; these are called stratus or nimbus cumuliformis.

It sometimes happens that a cumulus presents a mammilated lower surface. This appearance should be noted under the name of mammato-cumulus.

It should always be noted whether the clouds are stationary or in rapid motion.

[6] Tonitro-cirrus or thunderstorm-cirrus would be a better name than "false cirrus." *H. H. C.*

[7] At Blue Hill the symbols are used only to define a process and not a result. For example, ✳ means that snow fell at a certain time, not that snow lies on the ground at the time of observation. In a like manner ∞ means that ice formed over objects during a given interval, not that it covers the object at the time of observation. The same is taken as true of hail, sleet, frostwork, etc. Any other interpretation, it seems to us, would result in confusion, but this usage has not been definitely adopted by international agreement.—*H. H. C.*

2. Descriptive or introductory paragraph stating authority and reasons for using these symbols.

3. Table of symbols.

4. Paragraph describing the use of exponents, abbreviations for time, duration, etc.

5. Supplementary description or detailed explanation.

The great saving of space and time attained by the use of the symbols is indicated by the following example:

1 ◥ 9 p. — 10 p. in E; 3 ● 11 p. —; 4 ● — 10 a., ⚐◥ 3 p. — 5 p.

The translation of which is as follows: On the 1st, sheet lightning was observed from 9 to 10 p. m. in the east; 3d, rain began at 11 p. m. and continued during the night; 4th, rain ended at 10 a. m. and thunderstorm prevailed from 3 to 5 p. m.

The international symbols and their equivalents are as follows:

	English terms.	*French terms.*	*German terms.*
●	Rain.	Pluie.	Regen.
✳	Snow.	Neige.	Schnee.
⊠	Snow on ground.	Sol couvert de neige.	Schneedecke.
⊹►	Drifting snow.	Tempête de neige.	Schneegestöber.
←—	Floating ice crystals.	Aiguilles de glace.	Eisnadeln.
▲	Hail.	Grêle.	Hagel.
△	Sleet.	Grésil.	Graupeln.
V	Silver thaw, Frostwork.	Givre.	Rauhfrost, Duft.
∽∽	Glazed frost, Ice storm.	Verglas.	Glatteis.
⌙	Hoarfrost.	Gelée blanche.	Reif.
⌓	Dew.	Rosée.	Thau.
≡	Fog.	Brouillard.	Nebel.
≡!	Damp fog, mist.	Brouillard qui mouille.	Nebel welcher nässt.
≡	Ground fog.	Brouillard bas.	Bodennebel.
∞	Haze, dust haze.	Brouillard sec, brume.	Dunst, Höhenrauch.
⚐◥	Thunderstorm.	Orage.	Gewitter.
T	Thunder.	Tonnerre lointain.	Donner.
◥	Sheet lightning.	Éclairs sans tonnerre.	Blitz, Wetterleuchten.
≡≡	Strong wind.	Vent fort.	Starker Wind.
◯	Solar corona.	Couronne solaire.	Sonnenring.
⊕	Solar halo.	Halo solaire.	Sonnenhof.
◡	Lunar corona.	Couronne lunaire.	Mondring.
◡	Lunar halo.	Halo lunaire.	Mondhof.
◠	Rainbow.	Arc-en-ciel.	Regenbogen.
≈	Aurora.	Aurore polaire.	Polarlicht, Nordlicht.
⫙	Zodiacal light.	Lumière zodiacale.	Zodiakallicht.

The intensity of a phenomenon is denoted by an exponent; (⁰) indicating slight intensity, the absence of an exponent moderate intensity, and (²) great intensity.

The continuance of a phenomenon is indicated by a dash (—).

● *Rain.*—Indicates that rain is falling or has fallen during the day, since the last observation. [See foot note No. 7.—*C. A.*]

✳ *Snow.*—Indicates that snow is falling or has fallen since the last observation; ✳⁰ may be used to denote light snow, or snow in which only light scattered flakes fall; ✳² indicates a rapid fall of snow.

⊠ *Snow, on ground.*[8]—Snow lying on the ground, when more than half the ground in the neighborhood of the station is covered with snow. If the snow covering is thin use ⊠⁰; but if it is considered deep for the station use ⊠².

⊹► *Drifting snow.*—This symbol indicates that strong winds are raising the snow from the ground, filling the air with it, and transporting it horizontally; this may occur under a clear sky. The symbol does not refer to snow falling from the clouds, nor to the mere fact that the snow is lying in drifts on the ground. When the air is filled with blinding snow dust, use the symbol ⊹►², but for light snow dust use ⊹►⁰.

←— *Floating ice crystals.*[9]—Small ice crystals floating in the air usually observed during or immediately after very cold weather. If clouds are observed they are usually very thin and broken.

▲ *Hail.*—The fall of hard transparent ice pellets or nodules, whether small or large, crystalline or rounded. ▲⁰ indicates a small quantity of hailstones; ▲² a large quantity of hailstones, or a rapid fall of hail.

△ *Sleet.*—Pellets of snow, or soft hail, without any crystalline structure. This symbol is used by the Germans for graupeln or snow pellets, and for the semitransparent mixture of snow and ice that in central Europe nearly corresponds to the sleet of England and America. △⁰ should be used to indicate a small fall of sleet; △² much sleet.

V *Silver frost, or silver thaw. Frost-work.*[10]—This refers to an accumulation of frost on the limbs of trees, etc. The external appearance is silvery white and rough. It is observed during foggy weather when the temperature is below freezing or else after a cold spell when the temperature rises rapidly and stones, etc., remain colder than the air.

∽∽ *Glazed frost.*—This refers to an accumulation of ice on trees. The external appearence is smooth and transparent. In using the symbols for silver frost and glazed frost these terms are to be considered as descriptive of the resulting phenomena no matter how they are brought about, therefore the definitions avoid any statement as to the conditions attending the formation of the deposits. The same rule applies to the use of the symbol for hoarfrost.

⌙ *Hoarfrost.*— ⌙⁰ light hoarfrost; ⌙² heavy hoarfrost, injurious to vegetation. The expression frosty weather refers to the low temperature as such; but the expression hoarfrost refers to the deposit of fine ice crystals upon the surface of solids in the open air. Hoarfrost is generally deposited on objects under a clear sky at night.

⌓ *Dew.*— ⌓⁰ light dew; ⌓² heavy dew. As the formation of dew depends upon the nature and exposure of the surface on which the dew is deposited, the observer should use the same horizontal surface exposed uniformly throughout the season.

≡ *Fog.*—A dry fog enveloping the observer; ≡⁰ thin fog; ≡² heavy or dense fog.

≡! *Damp fog.*—A fog that wets as distinguished from fog that does not collect upon surrounding objects.

≡ *Ground fog.*—Fog that does not exceed the height of a man.

These fog symbols are not to be used when an observer at a high station observes fog in the valley below him; such an observation should be recorded as a note in the daily journal.

∞ *Haze.*—Such as makes distant mountains appear hazy, or such as covers the sky in the case of Indian summer haze, or prairie fires. If clouds are also prevalent in connection with this haze, the proper cloud symbol should be given in addition. The intensity, or density, of the haze is expressed by ∞⁰ for light haze and ∞² for dense haze. The symbol ∞ indicates merely the hazy condition or the optical result, without considering whether the haze is caused by dust or moisture.

⚐◥ *Thunderstorm.*—Thunder, whether with or without light-

[8] This symbol indicates that the ground near the station is more than half covered with snow. The depth may be indicated in a separate column or next the symbol, thus: ⊠10 or ⊠^{10}; but when this is done the exponent seems unnecessary.—*S. P. F.*

[9] This phenomenon resembles snow and occurs sometimes when the sky is nearly or quite clear and temperature quite low. It is probably sometimes recorded as "snow from cloudless sky."—*H. H. C.*

[10] This symbol is at present employed to indicate two entirely different phenomena: (1) the accumulation of frost-work on the windward sides of trees, buildings, etc., when enveloped in fog at temperatures below freezing, and (2) the coating of frost appearing on rocks, etc., when there is a rapid rise of temperature after protracted cold weather. The first phenomenon is frequent in winter on mountains.—*H. H. C.*

ning, rain, hail, or wind. This symbol will be used to indicate all cases when the storm is supposed to have passed near the station.

⊤ *Thunder.*—Distant thunder.

↯ *Lightning.*[11]—Distant lightning, usually called sheet or heat lightning. ↯⁰ faint lightning; ↯² brilliant lightning. When distant lightning appears at a definite direction in the horizon the observer should enter in the record the point of the compass, e. g., ↯⁰ NW. 10 p. for "distant heat lightning in the northwest at 10 p. m."

⟙ *Strong wind, or gale.*[12]—The feathering of the arrow may be varied to indicate the force of the wind according to the Beaufort scale, or the symbol, an arrow with 4 feathers, may be used to indicate a wind whose strength is 8, 9, or 10 on the Beaufort scale, or any velocity in excess of 50 miles per hour or 20 meters per second in absolute measures; ⟙² a remarkably strong wind or one exceeding 11 on the Beaufort scale or 80 miles per hour, or 35 meters per second.

⊙ *Solar aureole, corona, or glory.*[13]—Used for small circles of prismatic color surrounding the sun. The radii of these circles are usually less than 6°, but in the extreme case of Bishop's ring the radius is 15°. Several concentric circles are sometimes visible; each circular band of prismatic colors has its red on the outside and its blue, violet, or purple on the inside, with respect to the sun. Such rings are generally formed when the sun shines through a thin cloud, and may be seen if viewed through a neutral tinted glass or by reflection in water. A smaller circle surrounding the shadow of the observer's head is called an anthelion, aureole, glory, or fog shadow.

☋ *Lunar aureole or corona.*[13]—A small circle surrounding the moon similar to the solar corona.

⊕ *Solar halo.*[13]—Used for larger circles surrounding the sun, whose sizes are quite definite, namely, about 22° and 45° radius from the sun. They are easily distinguishable from the coronas by the fact that the colors are feebler and are so arranged that the red color is inside or nearest the sun and the blue color is outside. The greater part of the breadth of the halo is white. Complex combinations of halos, parhelia, horizontal circles, and vertical columns sometimes occur. In the symbol ⊕² the exponent indicates that the display is more brilliant than usual. A detailed statement of the radii or diameters of the rings and columns and of their arrangement should be given in the station journal.

☋ *Lunar halo.*[13]—A circle surrounding the moon similar to the solar halo.

◠ *Rainbow.*[13]—Brilliant rainbows may be indicated by ◠². When there are adjacent or supernumerary bows it should be indicated in the journal.

⌓ *Aurora.*—Any display of the aurora borealis or aurora australis.

☄ *Zodiacal light.*—The International Conference at Innsbruck, September, 1905, recommended that observations of this phenomenon be made wherever practicable. It is seen as a triangular beam of light rising from the horizon in the west after the end of evening twilight in the winter and spring, or in the east before daybreak from September to January.

DEPOSIT OF ICE COLUMNS.

By E. R. MILLER.

On December 25, 1905, the ground in the vicinity of Cabin John Bridge, eight miles west of Washington, D. C., was observed to be covered, especially where bare of vegetation, with a heavy deposit of ice columns. Where exposed to the sun the deposit had the appearance of rough shaggy fur; in shaded places the tops of the crystals were evenly covered with a thin crust of ice to which the crystals remained attached when lifted from the ground. The accompanying reproduction of a photograph shows such a fragment. The crystals photographed were about three inches long, and were of a fibrous appearance. The individual crystals were irregular in section and were from $\frac{1}{16}$ to $\frac{3}{16}$-inch in thickness. Most of the columns noticed had formed above the ground, but in some places they had formed in the soil.

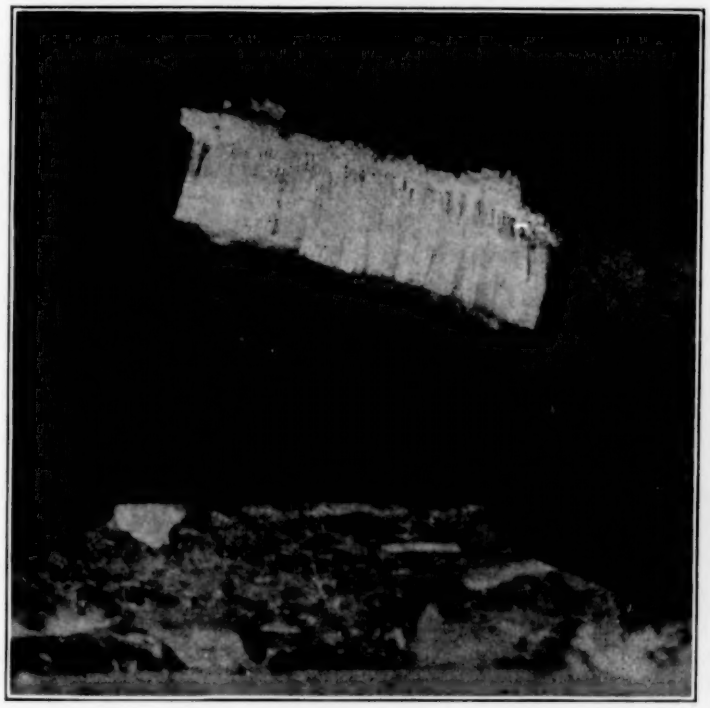

Fig. 1.—Deposit of ice columns.

The soil where the phenomenon occurred is loose and sandy. Rain to the amount of 2.03 inches (at Washington) fell during the night of the 20th and 21st followed by temperatures below freezing on the 24th and 25th, a minimum of 22° F. being recorded at Washington on the morning of the 25th.[1]

THE CLIMATE OF MADISON, WIS.

By JAMES L. BARTLETT, B. S., Observer, U. S. Weather Bureau. Dated November 27, 1905.

TOPOGRAPHY.

Madison, Wis., latitude, 43° 05′ north; longitude, 89° 23′ west, is situated in the southern portion of the State, about 75 miles west of Lake Michigan and the same distance from the nearest point of the Mississippi River. Locally, the city occupies a strip of land one-half to three-quarters of a mile wide, lying directly between Lakes Mendota and Monona, the former of which has an area of fifteen, and the latter an area of five square miles. The main portion of the city extends along the south shore of the larger lake. The site as well as the surrounding country is slightly rolling, some of the hills rising 100 feet, or more, above the level of the lakes. The elevation of the surface of Lake Mendota above mean sea level is 849 feet (see fig. 4).

HISTORICAL.

Meteorological observations were begun in Madison at the north dormitory of the University of Wisconsin, by Prof. S. H.

[11] The exponent when employed with this symbol should indicate degree of brightness or intensity, not relative frequency.—*S. P. F.*

[12] The definition of a gale varies with every locality. At some places, notably Mount Washington, and Ben Nevis, winds of 10 to 15 meters per second, 22 to 33 miles per hour, are too numerous to be noteworthy, while at less exposed places they would be quite rare, hence the symbol should indicate the occurence of an unusually strong wind or gale.—*S. P. F.*

[13] The exponent should indicate brightness, not size or complexity of structure.—*S. P. F.*

[1] See Monthly Weather Review, vol. 26, p. 217, and vol. 33, pp. 157–8.

Carpenter in January, 1853, and were continued with short lapses, by Prof. J. W. Sterling and Prof. W. W. Daniels, either there or in the neighboring main hall of the university, until October, 1878, except for a short period from March, 1856, to January, 1857, when the readings were taken by Dr. A. Schue at his office on Main street. From October, 1878, to April, 1883, the office of the United States Signal Corps was located in Madison, in Brown's Block, under the charge of the Sergeants F. M. M. Beall and C. A. Shaw. The station being discontinued at the latter date, the instrumental equipment was transferred to the north dormitory, and in August, 1883, to the Washburn Observatory (astronomical) at the university. At the last-named point observations were taken continuously under the supervision of Profs. Edward S. Holden and George C. Comstock, directors of the observatory, until December 31, 1904, when they were discontinued. The present station of the Weather Bureau was established on September 15, 1904, in the north hall, formerly north dormitory.

Most of the original records made during the earlier years have been preserved in the library of Washburn Observatory, although some are not to be found there. The observations made from 1869 to 1878[1] have been published in the Regents' Reports of the University of Wisconsin for those years, the report for the latter years also containing an interesting account by Prof. W. W. Daniels of some destructive tornadoes which occurred in extreme southern Wisconsin during that year. The observations taken from 1882 to 1893 have been printed in Publications of the Washburn Observatory.

INSTRUMENTAL EQUIPMENT AND EXPOSURE.

Beginning with October, 1878, the standard instruments furnished by the Signal Corps were used. These included maximum, minimum, dry and wet-bulb thermometers, an eight inch rain and snow gage, wind vane, anemometer, single register, and barometer.

The exposure at Washburn Observatory, where by far the greater portion of the observations was taken, was as follows: The thermometers were exposed in a wooden shelter of double louvre work, placed in the north window of the meridian circle room, eight feet above the ground. The anemometer and wind vane were placed upon supports on the roof and were about 35 feet above the ground. For the rain and snow gage a ground exposure near the observatory was used.

Washburn Observatory, main hall, and north hall are all situated on a slight ridge bordering the south shore of Lake Mendota, about 100 feet above the level of the lake and 600 feet distant from it.

GENERAL CLIMATIC SITUATION.

Southern Wisconsin enjoys a type of climate peculiar to continental interiors, characterized by great extremes of temperature. As it lies on the windward side of Lake Michigan, its atmospheric conditions are but slightly influenced by the Great Lakes. In general this is a region of warm summers, with occasional periods of extreme heat which may be interrupted by destructive local storms. The winters are somewhat cold and stormy, with frequent cold waves. The rainfall is sufficient for raising excellent crops, and is heaviest during the spring and early summer and least in the winter. About 50 per cent. of the possible duration of sunshine is recorded at the surface of the earth.

CYCLONIC STORMS.

Wisconsin lies almost in the main track of the transcontinental storms. Those coming from our north Pacific coast and western Canada pass across the northern border of the State, while many of the storms moving from the southwest toward the Great Lakes, pass near the southern boundary of the State. The storm centers, however, only infrequently touch the vicinity of Madison. Perhaps ten of these centers each year, or one-tenth of the whole, cross southern Wisconsin.

The paths of the centers of the anticyclones or high pressure areas also generally lie either north or south of this section. In the summer they pass on our north side over Lake Superior, in the winter on our south side over the middle Mississippi Valley to the south Atlantic coast. Each year, however, about half a dozen of these centers pass over this portion of the State.

Waterspouts have been observed on the Lakes. Thunderstorms are of frequent occurrence during the warmer months, and are sometimes accompanied by severe squalls. Destructive tornadoes have ravaged southern Wisconsin, but the nearest that one of any importance has ever come to Madison was ten miles farther south on May 23, 1878.

LOCAL WEATHER INDICATIONS.

Precipitation is usually preceded at Madison by southerly or southeasterly winds, and in winter and spring by winds from the east or northeast also. These winds also prevail during the occurrence of the greater portion of the precipition, though rain or snow may fall with wind from any point of the compass. During summer thunderstorms the wind usually shifts to a westerly direction before rain begins to fall, but these storms are as a rule preceded by southerly winds. Heavy falls of rain and snow are generally received from storms which come from the southwest and whose centers pass near this locality, but during the warmer months heavy rains may occur from thunderstorms in the southeast quadrant of a "low." The warm winds during the spring and autumn come from the south, in summer from southerly to westerly points, and in winter from the southeast. The cold winds come from north or west quadrants except during the summer when the colder winds blow from northerly to easterly directions.

TABULATED DATA.

The climatic data are summarized in Tables 1, 2 and 3. Records of temperature and precipitation were kept almost continuously from 1869 to the present time, but many of them are for shorter periods. Maximum and minimum temperatures have been observed only since October, 1878, at which time the record of wind movement also began, thus limiting this record to a 26-year period. The number of years and the dates for which the various data have been computed are noted at the foot of each table.

TEMPERATURES.

The large amount of water surface within a radius of five miles of Madison (about one-third of the total surface) naturally has some influence on the overlying and surrounding air. Lakes Mendota and Menona are open in general from April 8 to December 21 each year, although the exact dates of opening and closing vary much for different years. The exact amount of the influence of these lakes upon the local air temperature is, of course, very difficult to determine. To learn, if possible, the approximate value of this influence a comparison for identical periods of time was made between the temperature data for Madison and those for four cooperative observation stations of the Weather Bureau, located at Harvey, Portage, Beloit, and Dodgeville, which four cities are in southern Wisconsin within a radius of 45 miles from Madison and have no lakes in their vicinities.[2] Slight corrections were first made to the various mean values obtained to equalize the mean annual temperatures of the different places. It was then found that the temperature conditions at Madison differed from those of the other points by amounts quite similar for the four places. The averages of these differences have been plotted. (See fig. 1.)

From the above difference curves it may readily be seen that the tendency of the lakes is to lower the mean maximum

[1] All periods mentioned in this article include the dates by which they are limited.

[2] See Monthly Weather Review for April, 1905, p. 147.

TABLE 1.—*Climatic data for Madison, Wis.—Temperature.*

Months.	Mean of the max. and min.	Highest monthly and annual mean.	Lowest monthly and annual mean.	Mean maximum.	Mean minimum.	Mean daily range.	Means for three observation hours, on local time. 7 a.m.	2 p.m.	9 p.m.	Mean.*	Means of absolute monthly and annual extremes. Max.	Min.	Mean monthly and annual range.	Absolute extremes for the whole period. Max.	Date.	Min.	Date.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°		°	
January	16.4	33.5	6.3	24.1	8.6	15.5	14.0	21.3	17.6	17.6	43	— 15	58	58	6, 1880	— 29	7, 1887 21, 1888
February	18.3	34.0	7.5	26.3	10.3	16.0	14.8	24.4	19.9	19.8	45	— 13	58	63	12, 1882	— 28	9, 1899
March	30.4	38.4	21.9	38.3	22.4	15.9	25.0	34.5	30.0	29.9	58	2	56	73	28, 1905	— 12	5, 1890
April	46.0	51.8	40.2	54.8	37.1	17.7	40.3	51.7	45.5	45.8	76	21	55	86	12, 1887	8	3, 1886
May	58.2	66.6	51.8	67.4	48.7	18.7	53.4	64.2	57.7	58.2	82	36	46	88	29, 1881	27	7, 1885
June	67.6	71.4	63.2	76.9	58.3	18.5	63.4	73.7	66.7	67.6	88	45	43	94	26, 1901	38	1, 1897
July	72.4	79.8	66.7	81.4	63.0	18.5	67.5	78.4	71.4	72.2	91	53	38	104	21, 1901	48	30, 1891 9, 1895
August	69.8	75.2	65.0	78.4	61.1	17.3	64.3	76.2	68.9	69.6	89	50	39	96	8, 1894	46	24, 1896
September	62.0	67.8	57.4	70.6	53.5	16.9	56.3	68.2	60.8	61.5	85	39	46	92	5, 1881	29	30, 1899
October	50.4	59.2	44.4	58.4	42.4	16.0	44.2	55.4	48.8	49.3	77	27	50	84	4, 1897	12	25, 1887
November	34.6	41.8	26.8	41.5	27.7	13.8	29.9	37.8	33.2	33.5	60	8	52	68	3, 1904	— 14	28, 1887
December	22.7	34.9	12.4	29.2	16.2	13.0	18.9	25.4	21.8	22.0	47	— 7	54	60	24, 1889	— 26	27, 1886
Year	45.8	49.7[a]	42.2[b]	54.0	37.5	16.5	41.0	50.9	45.2	45.6	92	— 20	112	104	July 21, 1901	— 29	Jan. 21, 1888
Length and dates of data	27 years, from October, 1878, to September, 1905, inclusive.						32 years, from 1869 to 1874, 1876 to 1880, 1884 to 1904, inclusive.				27 years, from October, 1878, to September, 1905, inclusive.						

[a] 1878. [b] 1885 * By Mannheim formula $\frac{7\text{ a. m.} + 2\text{ p. m.} + 2 \times 9\text{ p. m. temperature}}{4}$

TABLE 2.—*Climatic data for Madison, Wis.—Precipitation.*

Months.	Average total precipitation.	Monthly and annual extremes. Greatest.	Year.	Least.	Year.	Greatest in 24 hours. Amount.	Date.	Average number rainy days.	Snowfall. Average total.	Greatest in 24 hours. Amount.	Date.	Droughts and rainy periods. Successive days without rain. Average number.	Greatest number.	Year.	Successive rainy days. Average number.	Greatest number.
	Inches.	Inches.		Inches.		Inches.			Inches.	Inches.						
January	1.66	3.59	1898	0.10	1903	1.80	1, 1892	8	8.5	9.4	20, 1898	3.8	26	1891	1.6	7
February	1.56	5.42	1881	0.26	1895	1.30	17, 1887	7	9.3	7.3	19. 1898	3.6	21	1899	1.6	5
March	2.18	4.73	1882	0.27	1895	1.95	3, 1881	9	7.6	11.0	21, 1886	3.5	18	1895	1.7	5
April	2.38	5.48	1880	T.	1877	2.15	18, 1880	9	1.0	4.8	13, 14, 1892	3.6	22	1895	1.8	7
May	3.49	6.98	1883 1892	0.51	1897	2.19	26, 1903	11	T.	T.	31, 1889	3.2	15	1881	2.0	6
June	4.19	9.31	1880	0.59	1895	3.47	14, 1880	11	0	.....	.....	3.0	15	1894	1.8	6
July	4.13	9.47	1881	0.79	1886	4.32	21, 1881	10	0	.....	.....	3.4	16	1879	1.7	5
August	3.10	6.83	1882	0.54	1894	3.25	16, 1886	9	0	.....	.....	3.9	17	1894	1.7	9
September	3.24	8.17	1881	0.38	1891	2.60	8, 1885	9	0	.....	.....	3.6	25	1891	1.7	6
October	2.48	9.12	1881	T.	1889	2.05	8, 1881	8	0.1	1.0	25, 1898	4.2	31	1889	1.6	5
November	1.76	6.02	1879	0.03	1904	2.61	6, 1885	8	3.0	4.5	6, 1900	4.1	20	1888	1.6	6
December	1.74	5.73	1884	0.21	1898	2.59	26-27, 1904	10	8.1	7.0	27, 1904	3.8	15	1890 1894	1.9	5
Year	31.91	52.93	1881	13.12	1895	4.32	July 21, 1881	108	37.6	11.0	Mar. 21, 1886	3.6	34	1888	1.7	10
Length and dates of data	36 years, from 1869 to 1904, inclusive.							26 years, 1879 to 1904.	21 years, 1884 to 1904, inclusive.			26 years, 1879 to 1904, inclusive.				

TABLE 3.—*Climatic data for Madison, Wis.*

Months.	Humidity. Relative humidity. 7 a. m.	2 p. m.	9 p. m.	Mean.	Vapor pressure.	Cloudiness. Scale, 0—10. 7 a. m.	2 p. m.	9 p. m.	Mean.	Average number of days. Clear.	Partly cloudy.	Cloudy.	Wind. Prevailing direction.	Average hourly velocity.	Maximum in 5 minutes. Velocity.	Direction.	Date.
	%	%	%	%	Inch.									m. p. h.	m. p. h.		
January	90	80	88	86	.077	6.3	5.9	5.1	5.8	8	11	12	nw.	10.1	40	n.	2, 1905
February	90	78	86	85	.089	5.8	5.8	4.7	5.4	7	11	10	nw.	11.0	40	.....	11, 1881
March	86	70	81	79	.130	6.1	6.1	5.2	5.8	8	11	12	nw.	11.4	45	.....	19, 1881
April	77	59	70	69	.211	5.6	6.0	4.7	5.4	8	12	10	s.	11.6	48	.....	10, 1879
May	76	59	72	69	.334	5.2	6.3	4.7	5.4	8	12	11	s.	10.3	36	.....	24, 1879
June	80	62	76	73	.482	5.1	5.7	4.4	5.1	8	12	10	s.	9.8	50	.....	5, 1880
July	80	60	74	71	.555	4.4	5.3	3.4	4.4	10	15	6	sw.	8.3	39	ne.	17, 1905
August	82	61	74	72	.536	4.8	5.6	3.2	4.5	10	15	6	s.	8.2	40	.....	—, 1879
September	84	65	76	75	.402	5.0	5.0	3.8	4.6	10	12	8	s.	9.9	45	sw.	30, 1881
October	82	63	74	73	.256	5.5	5.4	4.4	5.1	9	12	10	s.	10.8	44	sw.	16, 1880
November	85	72	80	79	.150	6.2	6.4	5.4	6.0	7	11	12	nw.	11.7	46	ne.	13, 1905
December	88	80	87	85	.098	6.4	6.3	5.4	6.0	7	10	14	nw.	11.1	40	nw.	7, 1881
Year	83	67	78	76	.277	5.5	5.8	4.5	5.3	100	144	121	nw.	10.3	50	.....	June, 5, 1880
Length and dates of data	30 years, from 1869 to 1874; from 1876 to 1880, and from 1886 to 1904, inclusive.					26 years, from 1869 to 1904, excluding Jan., 1875, to Oct., 1876, and Nov., 1878, to Dec., 1886, not computed.							36 yrs., 1869 to 1904.	26 yrs., 1879 to 1904.	5½ years, Oct., 1878, to April, 1883, and Oct., 1904, to Nov., 1905.		

temperatures throughout the year, to raise the mean minimum, and thus to decrease the mean daily range. The month of the most marked difference is August, which is noticeably very oppressive at Madison. The monthly mean temperature is lowered during the first five months of the year and raised during the remaining months. From January to March, each year, the lakes are almost invariably thickly coated with ice which has only a slight influence upon the surrounding air temperatures. However, when the ice is melting in the spring a large amount of heat is undoubtedly taken from the overlying air, which may account for the lowering of the mean temperature during March.

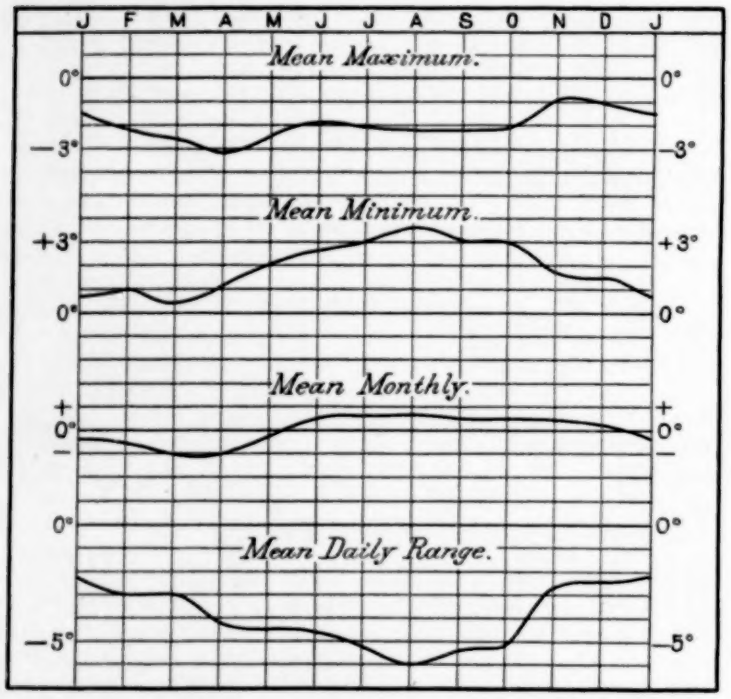

FIG. 1.—Average difference of temperatures at Madison from the combined means of Harvey, Portage, Beloit, and Dodgeville, showing the influence of neighboring lakes.

HOT PERIODS.

During the past 27 years there have been 150 days on which the temperature has risen to 90°, or over, or an average of about five and one-half days for each year. Frequently these high temperatures are recorded for a period of several successive days. The lengths of these periods and total number in 27 years have been as follows: fifteen successive days, one period; six successive days, one period; five successive days, two periods; four successive days, four periods; three successive days, eight periods; two successive days, sixteen periods; single days, forty-six times.

More than half of these hot days have occurred during the month of July, while August follows with about 20 per cent. The longest and most severe hot period occurred during July, 1901, when from the 13th to the 27th, the temperature rose above 90° every day, reaching 104°, the highest on record for Madison, on the 21st. During the same July there were six other days when a maximum of 90°, or over, was recorded, so that the whole month was abnormally hot; its mean temperature[1] was 80°, or a departure of 8° above the normal, and the highest monthly mean temperature on record for Madison. Most of the nights during this month were also very warm.

During July, 1887, a shorter but noteworthy hot period occurred. From the 11th to the 16th, temperatures of 90°, or over, were recorded each day. In July, 1894, from the 15th to the 19th, a period of five days, the thermometer rose above 90° daily. In July, 1886, a similar four-day period occurred, from the 25th to the 28th; this month contained another three-day period, from the 4th to the 6th, on the last day of which a maximum of 100° was recorded.

The longest hot period during June occurred in 1901, when there were five days, beginning with the 24th, on which maxima over 90° were registered. Another June hot spell extended from the 25th to the 28th, 1890.

In August, the longest hot periods have lasted only four days, namely: in 1881, from the 2d to the 5th, and in 1887, from the 1st to the 4th. September has had few hot days, but among these were three in succession, from the 4th to the 6th, 1881.

The highest summer average on record at Madison was that of 1901, with a mean temperature of 74°, or 4° above the normal, and the warmest winter that of 1889–90, with a mean temperature of 28°, or 9° above the average. The warmest year was 1878, with a mean of 50°, or 4° higher than the normal.

COLD SPELLS.

In calculating the length of cold periods in the winter, only those days have been considered on which the temperature did not rise above zero Fahrenheit. There have been nearly 80 of these days during the past 27 years, or an average of three each year. The lengths and number of cold spells during this time have been as follows: Five consecutive days, one period; four consecutive days, three periods; three consecutive days, three periods; two consecutive days, eleven periods; single days, thirty-one.

While the greater part of these cold days have occurred during January, which is as a rule the coldest month of the year, it is a notable fact that the longest and most intense cold spell occurred during February, of 1899, when the temperature did not rise above zero Fahrenheit, from the 8th to the 12th, and a minimum of 28° below zero was reached on the 9th. The average temperature for these five cold days was 15° below zero.

January, however, has had numerous cold spells, the most important of which were in 1883, 1884, and 1897, in all of which the mercury failed to rise above the zero point for four consecutive days. The coldest of these four-day periods lasted from the 4th to the 7th of January, 1884, with a mean temperature of 15° below zero and a minimum of 27° below; that of 1883 extended from the 20th to the 23d, with an average of 14° below zero; that of 1897 lasted from the 24th to the 27th, with an average of 12° below zero.

December being the warmest of the winter months, its cold spells are naturally shorter. Only twice in December since 1878 has the temperature failed to rise above zero for two consecutive days. These two-day cold spells occurred on the 18th and 19th, 1884, and on the 28th and 29th, 1880; the latter was the colder period, with an average temperature of 14° below zero.

It is somewhat noteworthy that the lowest temperature ever recorded at Madison, 29° below zero, did not occur during any of these long, cold periods. On January 7, 1887, this extreme was reached, but the temperature was above zero on both the 5th and 8th. Likewise on January 21, 1888, the temperature fell to 29° below zero, but the following day was again above zero.

COLD SEASONS.

The coldest month of which we have record was January, 1875, with an average temperature of 4°. The coldest summer was that of 1869, with an average temperature of 67°; the coldest winter, that of 1884–85, with a mean temperature of 10°; and the coldest year, 1885, when the temperature averaged 42°.

[1] All mean temperatures have been obtained from the sum of the daily maximum and minimum divided by two.

TABLE 4.—*Daily normal temperatures.*
[Means of 26 years, November, 1878, to October, 1904.]

Date.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	°	°	°	°	°	°	°	°	°	°	°	°
1	18	13	25	38	54	61	72	72	67	57	44	27
2	16	16	26	37	53	62	73	71	69	58	42	25
3	14	15	26	38	54	64	73	70	68	57	42	25
4	16	13	24	38	54	64	72	71	68	55	42	26
5	18	16	24	39	55	64	72	72	67	54	42	26
6	19	19	25	42	57	64	72	71	67	53	41	25
7	18	19	25	42	56	64	72	71	65	54	40	23
8	18	18	28	41	58	65	72	72	64	55	40	24
9	17	16	31	42	59	64	72	72	64	54	39	26
10	16	19	31	41	59	65	72	70	64	56	39	28
11	17	18	30	43	58	67	73	70	63	55	39	25
12	16	17	30	45	58	70	74	69	62	55	36	25
13	17	18	28	45	57	71	73	69	61	52	35	23
14	16	20	25	45	56	71	72	70	62	51	35	23
15	18	19	25	45	55	70	73	69	63	53	35	21
16	19	18	26	46	57	70	73	69	60	52	34	22
17	17	20	30	48	59	69	72	70	60	49	34	20
18	16	19	32	49	60	69	71	71	60	48	33	21
19	16	18	31	47	59	70	72	70	60	48	31	21
20	20	18	29	47	59	69	70	70	59	46	32	23
21	17	20	31	50	59	68	72	70	61	47	33	25
22	17	20	33	50	59	68	72	69	61	47	32	24
23	14	21	34	51	61	69	73	68	60	46	29	23
24	14	22	35	50	62	70	73	68	60	47	26	22
25	16	21	35	51	61	71	73	68	60	46	28	20
26	15	21	36	53	61	69	73	68	58	46	27	18
27	14	23	33	55	60	70	74	69	57	44	27	18
28	15	21	33	55	60	70	73	67	58	45	25	18
29	17	24	35	54	62	70	72	69	57	45	25	20
30	16	.....	36	53	60	71	71	68	57	44	25	18
31	15	.....	37	.....	60	.....	72	67	.....	44	.....	19

NORMAL TEMPERATURES.

The normal temperatures for each day of the year, as given in Table 4, have been computed from data for 26 years, from November, 1878, to October, 1904. The highest daily normal is 74°, which occurs on both the 12th and 27th of July; the lowest, 13°, occurs on the 1st and 4th of February. There are 43 days with a normal over 70°, 175 days with a normal over 50°, and 53 days with a normal below 20°.

TERDAILY TEMPERATURES ON LOCAL TIME.

As continuous self registration of the temperature has been kept only since September, 1904, the means of the observations, which were taken at 7 a. m., 2 p. m., and 9 p. m., local time, for many years, are of some interest as showing the relative temperatures at these three hours. These means are given in Table 1; fig. 2 shows the annual curve of variation for each of these terdaily means and also for the monthly means of the maxima and minima.

DIURNAL VARIATION OF TEMPERATURE.

For the year from October, 1904, to September, 1905, the mean hourly temperatures for each hour of the day have been computed, and are shown in fig. 3. As the mean temperatures for this year at 7 a.m., 2 p. m., and 9 p. m., differed but little from the 32 years' means for these hours, it may reasonably be believed that the curve represents, with an error of less than one degree at any point, the normal diurnal curve of temperature for this locality.

COMPARISON OF METHODS OF COMPUTING MEAN TEMPERATURES.

As mean daily temperatures are quite accurately computed from terdaily observations on local mean time by the use of the formula first recommended by the Mannheim Academy in 1780,

$$\frac{1}{2}\left[9\text{ p. m.}+\frac{1}{2}(7\text{ a.m.}+2\text{ p.m.})\right]=\frac{7\text{ a. m.}+2\text{ p. m.}+2\times 9\text{ p. m.}}{4}$$

therefore a comparison has been made, for the past year, between the means obtained by this method and those obtained from the maximum and minimum and the mean of 24 hours. A table of these comparisons follows. As is usually well known, the means obtained by the Mannheim formula appear to be slightly closer to the true mean than are the means of the maximum and minimum. Though of course the formula does not apply strictly to observations at 7 a. m., 2 p. m., and 9 p. m., standard mean time, yet the difference between standard ninetieth meridian time and local mean time at Madison is only two minutes, while a range of twenty minutes is allowed in making observations, therefore the two series can safely be combined together.

Month.	Mean of hourly observations.	Mean of maximum and minimum.	Mean by Mannheim formula.
1904.	°	°	°
October	50.3	50.7	50.3
November	39.7	40.2	39.7
December	21.5	21.4	21.8
1905.			
January	10.8	10.4	11.0
February	12.4	11.4	12.7
March	34.4	34.4	34.4
April	44.5	44.8	44.6
May	55.4	55.4	55.6
June	66.3	66.4	66.3
July	68.8	69.2	68.8
August	70.5	70.6	70.4
September	64.4	64.8	64.2

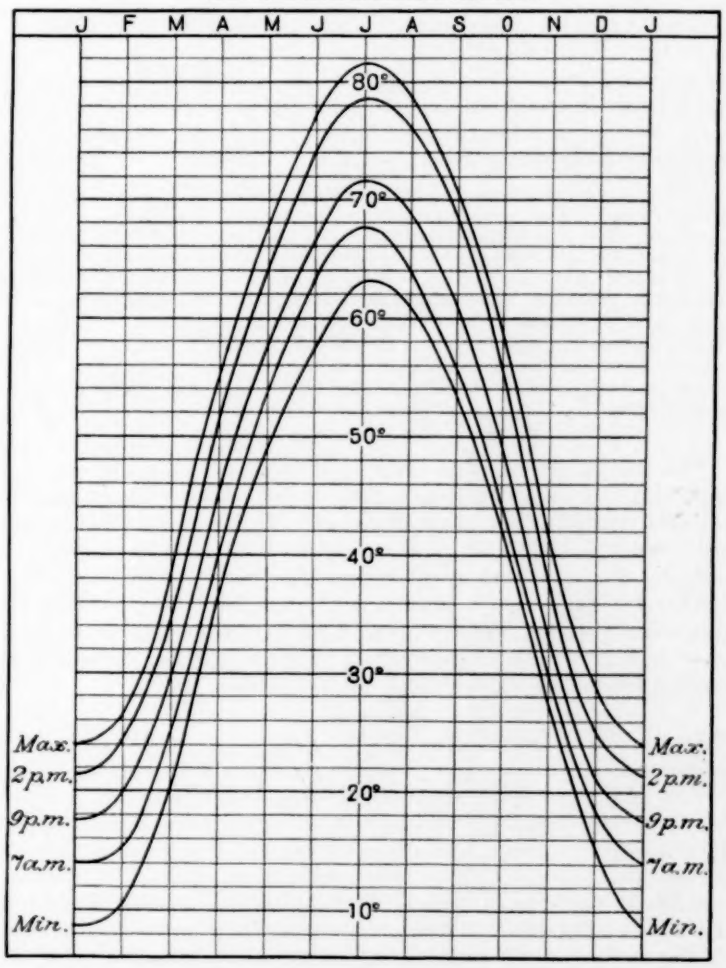

FIG. 2.—Annual curves of maximum, minimum, 7 a. m., 2 p. m., and 9 p. m. temperatures. (Average of many years.)

KILLING FROSTS.

Considering the dates of killing frosts as those on which a temperature of 32°, or lower, was recorded, it has been found that in the past 27 years the latest such frost in spring occurred on May 13, 1888, the earliest in the fall on September 30, 1883 and 1899. The average date of last killing spring frosts is April 21, and the earliest in the fall October 17. Comparing these dates for a number of years with the dates of similar phenomena at Harvey, Wis., which is directly east of Madison, away from any small lakes, but nearer Lake Michigan, it is

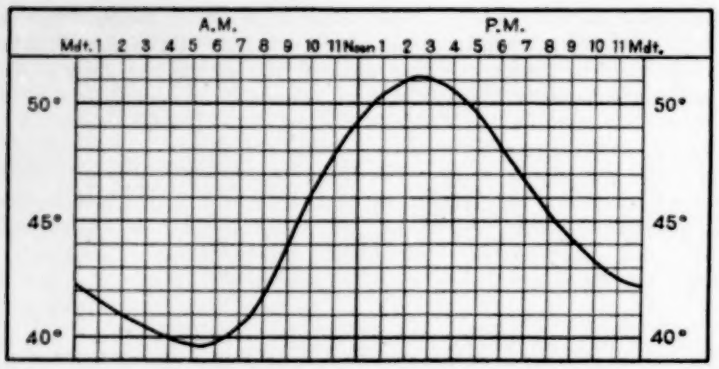

FIG. 3.—Curve showing mean hourly temperatures for one year, from October, 1904, to September, 1905, inclusive.

found that at Harvey killing frosts occur, as a rule, two weeks later in the spring and two weeks earlier in the fall. Thus the growing season is lengthened about one month at Madison, apparently by the influence of the presence of Lakes Mendota and Monona.

It is of course impossible to state exactly to what distance from these lakes their moderating influence upon the air temperature extends. With regard to the similar influence of the small lakes in the central part of the State of New York, Prof. L. H. Bailey, in The Principles of Fruit Growing, makes the following interesting statement:

> The distance to which the ameliorating influence of the water may extend is determined very largely by the conformation of the shore lands. As a rule, there are distinct slopes toward the water, and it is rare that the effect of the water upon the temperature extends beyond the crest of the elevation. As a matter of fact, when the elevation is 300 feet, or more, the region of immunity from frost ordinarily does not extend more than two-thirds of the distance to the summit. * * * The particular influence which the water exerts over injury by frost in the spring is often more due to the retardation of the period of bloom than to the actual prevention of frost, although its influence in the latter direction is important.

PRECIPITATION.

The precipitation means and extremes have been determined from data covering 36 years, 1869–1904. The average annual rainfall is a little less than 32 inches. In 1881 nearly 52 inches fell, while in 1895 only slightly more than 13 inches was collected. The greatest monthly rainfall was 9.47 inches, in July, 1881. In April, 1877, and in October, 1889, no measurable rainfall occurred. In all months except the first three falls of over 2 inches in 24 hours have been recorded, the greatest having been 4.32 inches, on July 21, 1881.

DROUGHTS.

Dry spells are of almost annual occurrence at Madison, and occasionally pronounced droughts occur. The average number of successive days without rainfall varies from 3.0 in June to 4.2 in October, the average for the year being 3.6. During 26 consecutive years, 1879 to 1904, the longest period without measurable rainfall was 34 days, from November 11 to December 14, 1888. Only a trace of precipitation occurred during the following periods: from September 30 to October 31, 1889, 32 days; January 2 to 27, 1891, 26 days; September 3 to 27, 1891, 25 days; January 29 to February 21, 1899, 24 days; April 9 to May 1, 1895, 23 days. Besides the foregoing droughts, there have been, during these 26 years, 21 periods of from 15 to 20 days without appreciable precipition. A drought of marked intensity occurred from October 11 to December 10, 1904, a period of 60 days, during which only 0.24 inch of precipitation occurred. Fortunately this was at a season of the year when it did no particular damage except through dust and the drying of the wells. A similar, though somewhat shorter, period extended from September 3 to October 16, 1905, 44 days, during which only 0.23 inch of rain fell.

RAINY PERIODS.

A rainy day, or a day with rain, is considered as one on which at least 0.01 inch of precipitation occurs during the 24 hours, 9 p. m. to 9 p. m., local time. It has been found that the average number of successive rainy days at Madison is quite constant for the various months, varying only 0.4 of one day through the year, and being greatest in May (2.0 days). The longest rainy period on record lasted ten days, from August 23 to September 1, 1880, during which rain fell every day in amounts varying from 0.01 inch to 1.42 inches. The total rainfall for this period was 4.29 inches, not a large amount, in view of the fact that 4.32 inches have fallen in a single day. By far the greater amount of precipitation occurs in single day periods. There have been, from November, 1878, to October, 1905, one period of ten successive rainy days, one of eight days, two of seven, six of six, 24 of five, and 76 of four days.

Besides the foregoing heavy rainfalls mentioned, there have been various periods extending over several days when large amounts of rain have fallen. The most important of these are as follows: May 21–27, 1903, 3.62 inches in seven days; May 6–13, 1904, 3.85 inches in eight days; May 9–16, 1905, 4.34 inches in eight days; June 2–15, 1880, 8.62 inches in fourteen days; June 2–9, 1883, 5.03 inches in eight days; June 2–5, 1890, 3.19 inches in four days; May 29–June 4, 1892, 3.47 inches in eight days; July 6–7, 1879, 4.34 inches in two days; July 20–24, 1881, 5.74 inches in five days; July 20–24, 1883, 4.37 inches in five days; July 23–24, 1884, 3.72 inches in two days; June 30–July 4, 1887, 3.92 inches in five days; July 13–20, 1900, 3.86 inches in eight days; July 16–23, 1902, 3.92 inches in eight days; August 23–September 1, 1880, 4.29 inches in ten days; August 13–15, 1882, 3.51 inches in three days; August 15–16, 1886, 3.27 inches in two days; August 22–29, 1903, 3.32 inches in eight days; September 1–6, 1887, 3.82 inches in six days; September 7–11, 1892, 3.21 inches in five days; September 8–12, 1901, 3.09 inches in five days; October 8–17, 1881, 5.88 inches in 10 days; November 8–12, 1879, 3.50 inches in five days.

The wettest spring on record at Madison appears to have been that of 1858, with a total precipitation of over 15 inches, twice the usual amount; the wettest summer, 1880, with 21.21 inches, nearly twice the average; the wettest fall, 1881, with 19.85 inches, over two and one-half times the usual amount.

SNOWFALL.

Data of snowfall, separate from its equivalent in water, have been tabulated, beginning with the year 1884. No record of snow falling in the months June to September has been found. The latest spring date of snowfall was May 31, 1889; the earliest in the fall, October 11, 1905. Months with heavy snowfall are as follows: January, 1898, 29 inches; February, 1887, 20 inches; February, 1898, 22, inches; March, 1886, 27 inches; March, 1891, 23 inches; December, 1887, 24 inches. The winter of 1885–86 witnessed the remarkably heavy fall of 76 inches; that of 1886–87, 60 inches; 1897–98, 71 inches. The winter with least snowfall was that of 1901–2, with only 4 inches.

HUMIDITY.

The readings of the wet-bulb thermometer, upon which the humidity data are based, were taken in window shelters during the years 1869–1874, 1876–1880 and 1886–1904, the thermometer being stationary. Usually the ventilation was good, but during the prevalence of light south or east winds the shelter at Washburn Observatory was in the lee of the building, in which case the readings might be appreciably affected. Steps are being taken to make such comparative readings as will give the corrections necessary to reduce the record by the still thermometer to the whirled thermometer. During the colder months, and especially with temperatures much below freezing, on frequent occasions no depression of the

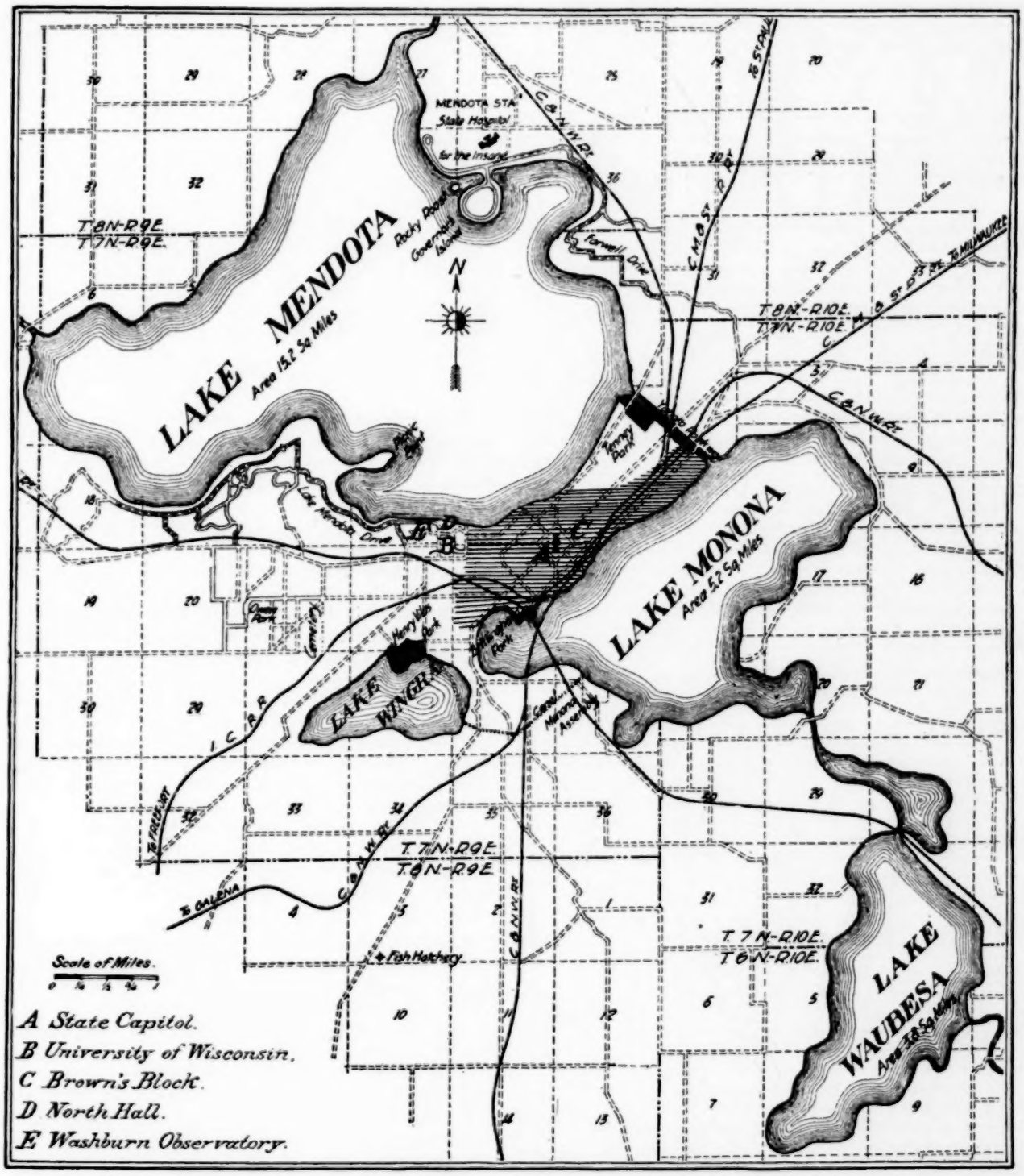

FIG. 4.—Map of Madison, Wis., showing the lakes in the vicinity and points where meteorological observations were taken. Shaded area shows main portion of city.

wet-bulb below the dry-bulb reading was obtained. It seems clear, therefore, that the humidity means computed for the winter months are somewhat too high. Curves showing the monthly means at 7 a. m., 2 p. m., and 9 p. m., respectively, derived from 30 years of data are shown in fig. 5. An apparently abnormal increase in humidity occurs in September, which may possibly be due to the peculiar moisture conditions produced by the lakes in the vicinity of Madison at that time as previously explained.

CLOUDINESS.

The mean cloudiness for each month has also been computed for 7 a. m., 2 p. m., and 9 p. m., respectively, and the annual curves for these hours have been plotted. (See fig. 6.) The cloudiness is greatest as a rule at 2 p. m. and least at 9 p. m. November and December are the cloudiest months of the year, the average cloudiness being then 60 per cent, while in July it is least—only 44 per cent. At 9 p. m. in August the mean cloudiness drops to 32 per cent, while at 2 p. m. in November and 7 a. m. in December it rises to 64 per cent. An abnormal increase in the cloudiness appears to occur in March.

WINDS.

The prevailing winds vary from northwest during November–March, to south during the remainder of the year. These

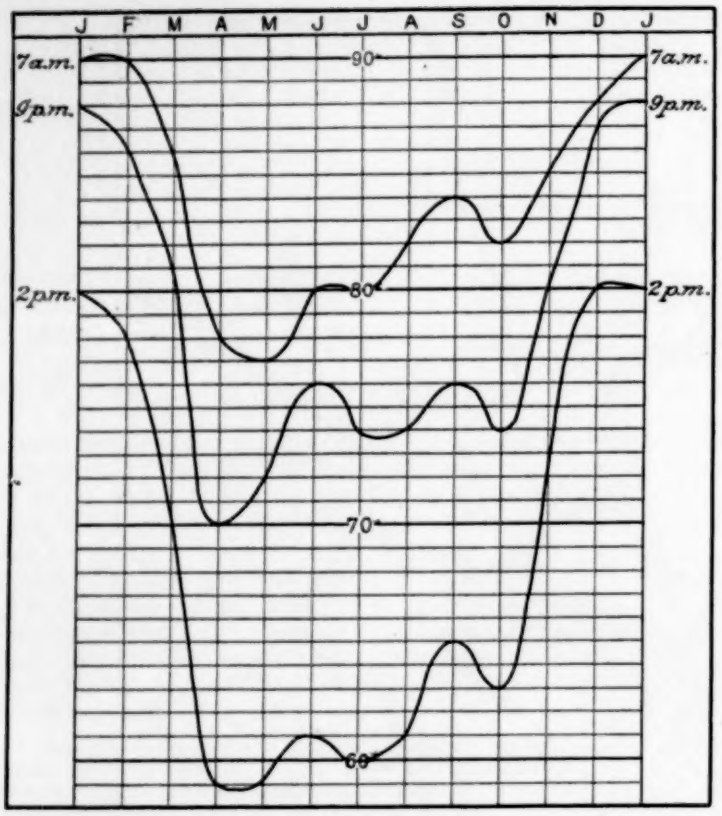

FIG. 5.—Annual curves of relative humidity at 7 a. m., 2 p. m., and 9 p. m., in percentages. (Average of 30 years.)

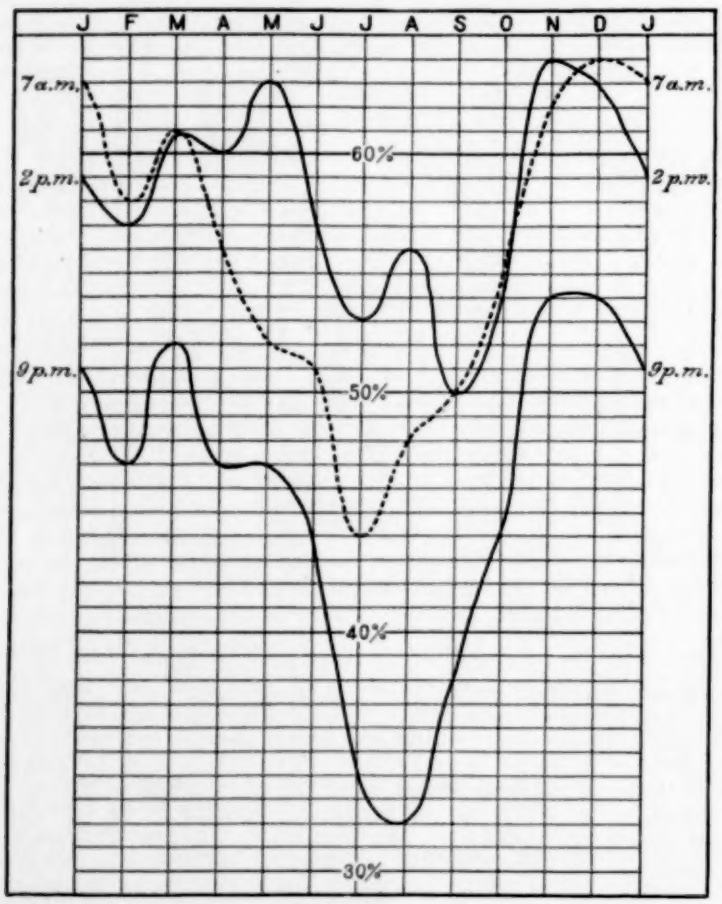

FIG. 6.—Annual curves of cloudiness at 7 a. m., 2 p. m., and 9 p. m. (Average of 26 years.)

two directions prevail nearly equally. The following table shows the number of times during the past 36 years that each direction has prevailed during the various months:

	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Variable.
January	2	1	0	0	4	8	7	14	0
February	3	0	0	0	5	4	8	16	0
March	5	1	0	0	3	1	7	17	2
April	3	3	1	3	7	6	6	5	1
May	3	5	2	3	8	7	0	5	2
June	4	0	3	2	11	10	3	2	1
July	4	0	0	3	8	11	2	8	0
August	2	1	0	0	18	5	1	8	1
September	0	1	2	0	21	7	0	5	0
October	1	0	0	3	14	8	4	6	0
November	3	1	0	1	7	4	4	15	1
December	2	0	0	1	6	5	9	12	1

TORNADO INSURANCE.[1]

By HOWARD E. SIMPSON, Instructor in Geology, Colby College. Dated Waterville, Me., December 30, 1905.

INTRODUCTION.

Much attention has been given by those interested in meteorology to the study of tornadoes, and an agreement has practically been reached as to their origin. The United States Weather Bureau goes as far as is deemed advisable in predicting from time to time "that conditions are favorable for severe local storms." All realize that the prevention of such storms is beyond human control. The little attention that is now being given to the subject is in the direction of the preservation of human life and security of property.

It is not intended that the present paper shall enter into a discussion of the relation of tornadoes to human life and safety, for the dangers have already been grossly exaggerated and the few practical means of avoiding them frequently pointed out. It is intended to show something of what has been done in the United States to afford protection by means of insurance against loss of property through tornadoes and lesser windstorms. Some conclusions will also be drawn regarding the tornado insurance business from the view point of one interested in its meteorological side.

While tornado insurance is almost unknown in some parts of the United States, or is heard of only after some particularly violent windstorm, in other portions of the country it is considered an important branch of the insurance business.

EARLY HISTORY.[2]

Little is known concerning the origin of tornado insurance, but as early as 1865 there were as many as seventeen companies organized under the laws of a single State writing this kind of insurance in connection with that of fire and lightning. In this period, however, the business was without a proper basis and has been aptly described as "The betting of stockholders' money on opinions." Another authority, as late as February, 1883, says, "It is at present only on a basis of guesswork, the business is limited, and the statistics few." Speaking further of the extent of the business and of the rates charged, the same authority gives several glimpses of its unstable character:

> Just how many companies have made a business of writing tornado risks in the West we have not ascertained, but that the business has been much more extensively prosecuted than eastern underwriters suspect is quite probable. Not less than 30 companies, and probably not more than 50, have made more or less of a specialty of tornado insurance, and with a tolerably even average of experience, leading in the same direction—that of disaster. * * * There being no guides to the business, each company ran according to its own mode of guessing, one charged one per cent for five years, another two, another six, and none could tell why this or that rate was charged.

[1] Written as a portion of the work done in the course in general climatology given by Prof. R. DeC Ward, of Harvard University, during the year 1904–5.

[2] The author is indebted to the Insurance Monitor, February to September, 1883, for many data regarding the early history of tornado insurance.

The business was, therefore, of an experimental nature, without reliable information on which to base calculations. Up to 1885, at least, tornado insurance was written largely in the form of a paster to an ordinary fire policy. This was certainly a very poor method for meeting such a peculiar risk.

LATER HISTORY.

The early eighties marked, in a way, the beginning of a new period in the history of tornado insurance. The studies on this subject by Prof. H. A. Hazen and Lieut. J. P. Finley of the United States Signal Service, and others, resulted in the publication of much data which formed a basis on which insurance calculations might be made. Of special value were the statistics concerning the frequency and distribution of tornadoes, and the damage resulting therefrom. Their conclusions were gravely at fault in not taking into account the relative areas of the respective States.[3] With the more reliable information, came lower and more uniform rates and an increased volume of business as may be seen from the tables which follow.

The results of the study of even the more recent history of the subject are far from satisfactory. One of the chief reasons is the confusion which exists in the popular mind regarding the use of the terms tornado, cyclone, hurricane, etc. This confusion is common in the newspapers where tornadoes are usually reported as "cyclones" and inaccuracies have crept into the United States Weather Service reports when straight winds have been reported by the voluntary observers as tornadoes. The Weather Bureau is however doing much to correct these errors by increasing the number of trained observers, by a careful selection of the voluntary observers, and the general circulation of meteorological information among the people.

From what has been said it is not surprising that practically all forms of windstorm policies are known as "cyclone insurance" and even to-day the majority of the companies write against "cyclones, tornadoes and windstorms." There is a recent tendency on the part of the leading companies to recognize in the tornado the greatest source of loss from wind, and some are using the term "tornado insurance" to cover all policies insuring against damage by wind. In this they include large amounts written in the Gulf and South Atlantic States for protection from the tropical hurricanes which occasionally strike that region with great violence. This might be termed "hurricane insurance" since its hazard is quite distinct and the risk, judged by the present rates, far exceeds that of the tornado in the Mississippi Valley.

Another serious obstacle to the study of tornado insurance is the fact that a large portion of the business is written by companies also engaged in fire and marine insurance and no separate record is kept, or at least no separate report is given out. It is impossible to form an accurate estimate of the amount of the business done by these companies. This fact should be borne in mind in reading the statistics given hereafter in this paper.

A third difficulty, largely perhaps the result of the preceding one, is the fact that very few States require their departments of insurance to make separate reports of this business. Only in the State of Missouri is a complete and distinct report on tornado insurance made. In several other States, as Illinois, Iowa, and Wisconsin, reports are made of the companies doing an exclusive tornado business. In Minnesota tornado is combined with hail insurance, a new and rapidly increasing class of business, which in this State is already far in excess of the tornado insurance.

The following extracts from several of the most valuable of the State and United States reports, covering the past 25 years, will give some idea of the development and extent of tornado insurance, and afford a basis for some brief conclusions.

The Eleventh Census of the United States furnishes the only available general view of the business of tornado insurance. Unfortunately these statistics are not very recent and probably far from complete, owing to the reasons already stated in this paper. They cover, however, a very interesting period in the history of tornado insurance and include the transition from the period of experimentation to the beginnings of a scientific basis. The amount of the business by years, from 1880 to 1889, inclusive, is given in Table 1. It is a matter of great regret that the Twelfth Census has made no investigation relating to insurance, and the need is not supplied by any other bureau of the Government.

Perhaps the most striking fact shown by Table 1 is the steady growth of the business from $4,000,000 to over $21,000,000 in the decade from 1880 to 1890, the only marked exception being the falling off of about $2,000,000 in the year 1887. While no definite information is at hand, all indications point to the fact that there was but a small business in this line before 1880, perhaps a few millions a year at most, and that this was handled largely by the fire insurance companies without a separation of risks. The rapid growth in the early years of this decade may be accounted for in part by the publicity accorded the subject during these years through the reports of the United States Signal Service, and the general agitation of the subject in the press of the country at that time. Another good reason seems to lie in the fact that several very severe tornadoes occurred during this group of years, especially in 1882 to 1884, inclusive. Judging from the reports of the United States Signal Service, this was a period of unusual tornado severity. This may also have been the cause of the public agitation of the subject.

TABLE 1.—*Tornado insurance business during the years 1880–1889.*

[Compiled from the Eleventh United States Census.]

Year.	Amount written or renewed.	Premium received.	Losses paid.	Average amount of premium per $100 risk.	Average amount of loss per $100 risk.	Average amount of loss paid for each $1 premium
1880	$3,928,200	$74,702	$24,703	1.9017	0.6289	0.3307
1881	5,642,254	105,192	31,554	1.8644	0.5592	0.3000
1882	10,655,811	191,618	52,112	1.7966	0.4887	0.2720
1883	14,629,036	240,611	66,325	1.6447	0.4534	0.2757
1884	17,806,024	319,753	83,618	1.7958	0.4696	0.2615
1885	18,416,581	303,762	87,951	1.6494	0.4776	0.2895
1886	21,390,669	306,213	95,871	1.4315	0.4482	0.3131
1887	19,469,476	278,768	111,541	1.4318	0.5729	0.4001
1888	20,223,327	266,884	90,866	1.3197	0.4493	0.3405
1889	21,295,370	277,614	90,762	1.3036	0.4262	0.3269
Total	$153,466,748	$2,365,117	$735,313	1.5411	0.4791	0.3109

The rapid rise during these three years was followed by a much slower rise in the two following years and by a decided decrease in 1887. This was probably due to a decrease of interest and to the fact that it was the custom to write these policies for a period of three or five years, and therefore many written in the years 1882 to 1884 expired at this time and were not renewed, the general fear being somewhat allayed. This is a peculiar characteristic of tornado insurance in its earlier history.

This decade was also a period of rapid development of tornado insurance on the local mutual plan, especially through the agricultural districts of the Middle West.

The distribution of tornado insurance by States, as compiled from the Eleventh Census, is shown in Table 2 and on the accompanying map, fig. 1. The thousands written are shown in roman and the losses paid by thousands in *italics* in the several States. It is of interest to note that in a general way the figures correspond to the distribution and frequency of tornadoes as shown in Lieutenant Finley's report.

[3] C. Abbe's "Tornado frequency per unit area," Monthly Weather Review, June 1897, p. 250, and Annual Report Smithsonian Institution, 1888, p. 420.

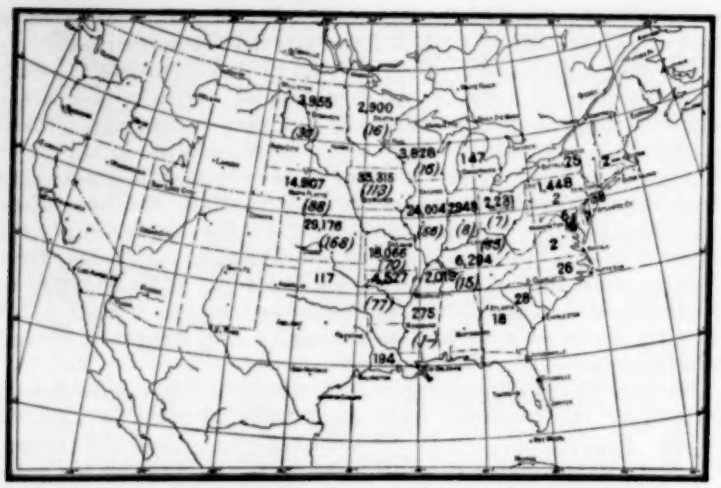

FIG. 1.—Map showing the distribution of tornado insurance by States—1880–1890. Compiled from data of the Eleventh United States Census.

TABLE 2.—*Tornado insurance business in the United States* for the years 1880–1889.*

[Compiled from the Eleventh United States Census.]

State.‡	Risks written.	Received premium, or assessments.	Paid losses.	Average premium per $100 risk.	Average loss per $100 risk.	Average am't of loss paid for each $1 premium.
Arkansas	$4,527,154	$124,198	$77,099	$2.7434	$1.7030	$0.6208
North and South Dakota	3,954,610	67,461	29,595	1.7059	0.7484	0.4387
Illinois	24,004,062	388,186	56,209	1.6172	0.2342	0.1448
Indiana	2,949,336	27,160	7,755	0.9209	0.2629	0.2885
Iowa	†8,450,622	11,092	1,845	0.1513	0.0219	0.1676
	26,864,547	365,530	111,072	1.3361	0.4125	0.3087
Kansas	29,175,693	540,647	168,242	1.8531	0.5167	0.3112
Kentucky	6,294,337	122,789	65,338	1.9500	1.0380	0.5332
Minnesota	2,900,078	34,292	15,830	1.1825	0.5458	0.4616
Missouri	18,065,839	258,572	70,320	1.4313	0.3892	0.2720
Nebraska	14,906,836	394,845	88,440	2.0426	0.5933	0.2905
Ohio	2,231,425	23,120	7,034	1.0361	0.3152	0.3042
Pennsylvania	†61,600	177	.....	0.2873	.....	.....
	1,386,909	3,217	1,600	0.2320	0.1154	0.4974
Tennessee	2,018,532	44,660	15,470	2.2125	0.7664	0.3464
Wisconsin	3,827,772	44,157	16,381	1.1536	0.4280	0.3710
Total United States	$153,466,748	$2,365,117	$735,313	$1.5411	$0.4791	$0.3109

*The whole amount of tornado insurance is not shown, as most of the companies include the tornado business with the fire business and report it all under the head of the latter. In the accompanying table only tornado business reported separately is shown.

‡States having less than $1,000,000 are omitted from table.

†Business marked thus is by companies doing businesson the mutual plan and insuring only dwellings and contents of farm property. All other is by companies having joint stock capital.

The annual reports of the various State commissioners or superintendents of insurance, while very complete on most lines, give little practical information to the student of tornado insurance, since in most cases only the business transacted by the local mutual companies doing an exclusive tornado business is reported as such. The State Superintendent of Insurance of Missouri has, however, presented a complete report for the last few years and the statistics given in Table 3 compared with those of the United States, already given, form an interesting study. The Missouri report begins practically where the United States report ends and in that way they supplement each other.

The data regarding tornado insurance in Missouri are of interest from the fact that they have been carefully compiled, especially since 1896, and for the reason that, according to the reports of Lieutenant Finley of the United States Signal Service, Missouri is the State most frequently visited by tornadoes. The history of the business from 1890 to 1900 as shown in Table 3, bears a strong resemblance to that of the United States in the preceding decade.

Starting in 1890 with about the same amount that was written in the whole United States in 1880, the business seems to continue uniform for a couple of years. A marked increase for two years is followed by as marked a decrease for another two years. Of this the State Actuary, Mr. August A. Harvey, to whom much is due for the excellent series of State reports, says in his Annual Report of 1895: "The tornado business has fallen off, because cyclones(?) did not prevail during the years 1893 and 1894 as in 1892." In this statement he accounts, in part at least, for the marked increase already mentioned.

TABLE 3.—*Tornado insurance business in Missouri for the years 1889–1903.*

Year.	Risks written.	Premiums received.	Losses paid.
1889	$ 2,363,700.00	.....	.....
1890	2,409,000.00	$ 31,635.69	$ 2,412.44
1891	2,340,700.00	31,508.61	470.05
1892	2,784,800.00	34,914.99	6,604.65
1893	4,484,993.00	50,269.22	6,698.65
1894	2,964,600.00	39,234.41	1,709.76
1895	1,781,589.00	20,873.74	2,511.62
1896*	12,233,167.00	65,092.78	60,203.57
1897	17,733,373.00	89,340.19	12,451.06
1898	15,963,441.00	85,309.64	22,895.32
1899	31,458,796.17	134,671.56	17,544.83
1900	22,096,701.00	90,129.67	10,440.55
1901	28,435,469.44	124,110.55	5,307.03
1902	23,326,518.00	118,246.29	16,457.78
1903	24,606,083.55	140,008.94	24,174.18

* The estimated business for 1896 is $16,233,167.00. William D. Murray, Deputy Superintendent of the Insurance Department of Missouri, in the report for 1897, says: "The tornado items for 1895 and 1896 are not true. The great disaster of last May brought out the fact that some thirteen companies wrote tornado risks in Missouri of which no report had been made to the insurance department."

The phenomenal advance in business in 1896 is a still greater testimony to the effect of severe tornadoes on the purchase of tornado insurance. The St. Louis tornado, referred to in the report of the year following as "The May Disaster," carried the sales up from $2,000,000 to $12,000,000 and revealed the fact that several companies were still doing tornado business, and reporting it as fire, to an amount estimated at $4,000,000. The impetus thus given caused a still further increase to nearly $18,000,000 of business in 1897, but the fright having lessened it fell away somewhat in the year following.

Greater than either of the advances mentioned, came the boom of 1899. This was probably the combined result of two principal causes whose relative individual importance can not be determined. In this year came both the noted Kirksville tornado with its great destruction of life and property, and the reduction of the cost of tornado insurance by about 50 per cent. The latter was brought about through the efforts of the State Insurance Department and went into effect at the beginning of the year. That such a reduction of rates was possible, shows something of the unscientific basis of this form of insurance as late as 1899. That it was carried out voluntarily is much to the credit, not only to the superintendent of insurance, but also to the companies doing business in the State.

While the figures show a great fluctuation in the amount of tornado insurance written, they indicate, on the whole, a very decided increase in the business. The incomplete data furnished by the reports from the other States show that the growth was general and, taken as a whole, not subject to the fluctuations characteristic of any one local area.

The early rates, as already suggested, were based on the merest guesswork, varying with the different companies from 1 to 6 per cent for five years, increasing in proportion for shorter periods. In 1883 the rate of 50 cents per hundred for a single year seems to have been generally adopted, with $1 and $1.50 for three and five years, respectively. This applied only to well built structures, while churches with steeples, three story buildings, etc., called for a decided advance. This rate was not based on ascertained data, but appears to have been adopted experimentally. Owing to the supposed greater destructiveness of tornadoes in Missouri and Kansas the rates were highest in these States; Illinois, Iowa, Wisconsin, Minnesota, and the other States of the upper Mississippi

Valley closely following. In general we may say that at this time the rates in tornado insurance were equal to those of fire and lightning combined, though it was beginning to be recognized that there ought to be a great difference between them in favor of the former.

The American Meteorological Journal of May, 1884 (Vol. I, p. 10), commenting on State Actuary Harvey's report for Missouri, says: "Both nature and the companies have discriminated a little against Missouri," and gave the following data:

	Per cent.
Average rate of premium in general	1.41
Average rate of premium in Missouri	1.59
Average loss of amount written in general	.17
Average loss of amount written in Missouri	.44
Average loss of premium in general	12.21
Average loss of premium in Missouri	27.59

The general scaling down of rates in this State already mentioned, which came fifteen years after this report was published, was certainly needed in view of these facts.

There seems to have been a considerable uniformity in limiting the amount of a single risk to either $3000 or $5000. Many companies also limited the minimum amount adjustable in a single loss to $10, $25, or $50 owing to the cost of adjustment. In this way the damages from slight gales were not included in the risk.

THE PRESENT STATUS OF TORNADO INSURANCE.

The amount of tornado insurance now written can not be calculated, but from the best data at hand in seems that $500,000,000 annually would not be an over estimate. This compared with some other classes of the insurance business is small, but is believed to be slowly increasing. The business is still largely handled by the fire insurance stock companies and this part of it is steady and reasonably permanent. A considerable portion is, however, written by the local mutual companies, much of it on the assessment plan, and is, therefore, more subject to fluctuation from local causes. On the whole it will probably remain a small but important and permanent branch of insurance in this country, especially in the Mississippi Valley and along the south Atlantic and Gulf coasts.

Twenty-two years ago the editor of the insurance Monitor said, regarding rates: "It would seem that less than a fifth or perhaps a tenth of 1 per cent, under judicious policy form, should furnish abundant security against actual risk in sections most liable to tornadoes." The wisdom of his estimate, in view of the current rates to-day, may be seen by a quotation of the rates of one of the leading stock companies now doing business throughout the United States. Their risks are limited to $5000 and subject to further careful restrictions.

TABLE OF CURRENT RATES.

	1 year.	3 years.	5 years.
Dwellings and other substantial buildings	.10	.25	.40
Barns	.15	.37½	.60
Churches with steeples and towers	.25	.62½	1.00
Southern cities, 50 miles from seacoast.			
Dwellings and other substantial buildings	.25	.50	.75
Barns, with dwellings	.30	.60	.90
Churches with steeples, stocks, and tobacco warehouses	.50	1.00	1.50
Southern States, seaport cities.			
All substantial buildings	.75	1.87½	3.00

From these rates it may be inferred that the hurricane risk on the southern coast is believed by the companies to be seven and one-half times as great as the tornado risk in the States where tornado insurance is generally purchased.

Fire insurance has been reduced to a scientific basis. So much can not be said of tornado insurance. The hazard in the latter is probably far less than the former, but is just as real. The tornado hazard varies in different localities, but this variation could be determined as it has been in the case of fire. Great storms, such as the Louisville and St. Louis tornadoes and the Galveston hurricane, would overturn these calculations and embarrass some companies as the Boston, Chicago, and Baltimore fires did in fire insurance; the results, however, would be but temporary.

That the law of chances applies in tornadoes can not be doubted, since they are natural phenomena and are, therefore, apt to occur in any district with some degree of uniformity since the conditions which produce them are climatic. The popular belief that tornadoes are on the increase is unwarranted by any recorded observations.

The increase in the amount of destruction and the number reported is due to the increased settlement of the country. Prof. Cleveland Abbe, in 1884, 1888, and 1897, called attention to the fact that the popular idea of the destructiveness and frequency of these storms in some States has resulted, to a large extent, from the neglect to make proper allowance for the relative areas of the respective States and the tornado itself, and that the risk can only be deduced from a study of the frequency per unit area.[4] He has computed a table (Table 4) showing the annual average frequency of tornadoes per unit area for the different States, based on the observations of sixteen years as compiled by Lieutenant Finley and Mr. A. J. Henry, and shows that even in the so-called tornado States the probability that any specific area the size of an average farm will be struck by a tornado is much less than one-sixteenth of one per cent per century, which is less than the probability that it will be devastated by fire or lightning. The table is repeated here in order to show how greatly exaggerated has been the fear of tornado destruction in certain States. It may be noted that unit areas (of 100 miles square) in Massachusetts, Maryland, or New Jersey have about the same percentage of destructive tornadoes per century as in Iowa, Kansas, or Illinois.

The tornado risk has some peculiar phases. The criminal hazard is wanting. Houses can neither be blown down for indemnity nor blown away through carelessness. The tornado path is limited in extent, being but a few yards to a half mile in width and a few miles in length. The tornado moves in an easterly direction, usually from southwest to northeast. There is, however, a tendency to a simultaneous appearance of several small tornadoes in the same region, moving along parallel lines. The tornado season is practically limited to the summer, 65 per cent occurring from April to August. The violence varies greatly in different regions, in different seasons, and in different parts of the same storm.

While it is true that no building will withstand the power of the wind in the vortex of a tornado, yet the side winds are of such varying strength that the degree of injury and therefore value of the risk depends largely on the material and construction of buildings. Among the risks prohibited by the conservative companies, are the following:

Thatched, frail, very old and dilapidated structures of all kinds.

Buildings on posts, or open at the bottom.

Buildings in course of construction, until roof, windows, and doors are all in place and secure.

Windmills, metal smokestacks, sheds, trees, and fences.

Awnings, signs, and large plate-glass windows.

Hay and grain in the stack.

Personal property in prohibited buildings.

Live stock, except when within insured buildings.

To these may be added many risks which are prohibited unless built with special care, such as buildings with towers, cupolas, and steeples; elevators; shaft houses; warehouses and hothouses.

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[4] See Smithsonian Report for 1888, pp. 403 and 420.

The fact that windmills are generally prohibited on account of the great hazard involved has caused the formation of windmill insurance companies in several States which insure windmills of substantial construction at the rate of one dollar per year.

TABLE 4.—*Tornado frequency.*

States.	Area in units of 10,000 square miles.	Total number of tornadoes.			Annual average.	
		1874–1881. Finley.	1889–1896. Henry.	Sixteen years.	Per State.	Per unit area.
Alabama	5.1	12	13	25	1.56	0.30
Alaska	51.7	0	0	0	0.00	0.00
Arizona	11.4	2	0	2	0.12	0.01
Arkansas	5.2	8	18	26	1.62	0.31
California	15.8	1	0	1	0.06	0.00
Colorado	10.4	1	1	2	0.12	0.01
Connecticut	0.5	2	0	2	0.12	0.24
Delaware	0.2	0	0	0	0.00	0.00
District of Columbia	0.0	0	0	0	0.00	0.00
Florida	5.9	5	1	6	0.38	0.07
Georgia	5.8	29	12	41	2.56	0.44
Idaho	8.6	0	0	0	0.00	0.00
Illinois	5.5	50	29	79	4.94	0.90
Indiana	3.4	24	7	31	1.94	0.57
Oklahoma and Indian Territory	6.9	1	13	14	0.88	0.13
Iowa	5.5	26	28	54	3.38	0.61
Kansas	8.1	55	47	102	6.38	0.79
Kentucky	3.8	5	11	16	1.00	0.27
Louisiana	4.1	11	7	18	1.12	0.28
Maine	3.5	3	3	6	0.38	0.11
Maryland	1.1	8	3	11	0.69	0.63
Massachusetts	0.8	7	1	8	0.50	0.62
Michigan	5.6	13	5	18	1.12	0.20
Minnesota	8.4	21	22	43	2.69	0.32
Mississippi	4.7	9	15	24	1.50	0.32
Missouri	6.5	40	16	56	3.50	0.54
Montana	14.4	1	0	1	0.06	0.00
Nebraska	7.6	14	22	36	2.25	0.31
Nevada	11.2	1	0	1	0.06	0.00
New Hampshire	0.9	3	0	3	0.19	0.21
New Jersey	0.8	5	6	11	0.69	0.86
New Mexico	12.1	1	0	1	0.06	0.00
New York	4.7	20	5	25	1.56	0.33
North Carolina	5.1	14	2	16	1.00	0.20
North Dakota	7.1	4	2	6	0.38	0.05
Ohio	4.0	21	8	29	1.81	0.45
Oregon	9.5	0	0	0	0.00	0.00
Pennsylvania	4.6	17	13	30	1.88	0.41
Rhode Island	0.1	0	0	0	0.00	0.00
South Carolina	3.4	13	3	16	1.00	0.30
South Dakota	7.7	5	21	26	1.62	0.21
Tennessee	4.6	15	10	25	1.56	0.34
Texas	27.4	18	35	53	3.31	0.12
Utah	8.4	0	0	0	0.00	0.00
Vermont	1.0	2	0	2	0.12	0.12
Virginia	6.1	9	2	11	0.69	0.11
Washington	7.0	0	0	0	0.00	0.00
West Virginia	2.3	1	0	1	0.06	0.03
Wisconsin	5.3	11	10	21	1.31	0.25
Wyoming	9.8	1	0	1	0.06	0.01

Most companies write policies only for one, three, and five years, limiting the amount on a single risk to $5000. They also require the insured to maintain tornado insurance on the property to at least 50 per cent of its cash value. The minimum limit of damage adjustable for any single loss has now been generally abandoned.

The careful distribution of risks is an important factor in successful tornado insurance. Special rules are not generally necessary for large companies doing business over wide areas in several States, the law of chances being relied on to prevent great loss. The present system of State, county, and township tornado mutual insurance companies is, however, open to serious criticism since, as a rule, careful distribution is not strictly enforced. A single tornado is in such cases as destructive to the companies as to the property in its path.

THE LOCAL MUTUAL COMPANIES.

The local mutual tornado insurance companies so common in the States of the Middle West have been developed from the local fire mutuals from which many of them have never been distinctly separated. Their history is varied, and, in most cases, a sad one. For this there are several reasons. In some States they have in turn taken up hail insurance which is as far from being established on a scientific basis as tornado insurance was 25 years ago. Little or no regard has been paid to the distribution of the risks. The failure of a large percentage of the members to pay their assessments, after receiving protection for the time agreed, has caused the failure of many companies and the embarrassment of more.

The Insurance Commissioner of Minnesota, in his report for 1904, says:

> It is clearly evident in view of failure on the part of a large percentage of the members to pay their assessment fees, that the only practical course to be pursued in conducting this class of business is to require the payment of the full premium in cash or secured bankable notes upon the delivery of the policies. In other words, no company should assume a dollar of liability on account of losses through hail, cyclones, or other contingency, until the cash funds with which to pay the same have been actually collected from the members or policy holders.

This is now required by law in Minnesota.

Regarding the township mutual fire insurance companies, the same report says:

> I have no hesitancy in stating, and without fear of contradiction, that no other class of business, whether that of insurance or any other line, is conducted so eminently successfully at such a very small cost. The average cost per $100 of insurance on account of losses by fire during 1904 was 10 cents. The average cost of expenses was but 5 cents, making a total cost of but 15 cents per annum for fire insurance under this method.

This goes to show not only the success but the cheapness of local insurance companies under proper restrictions. Mutual tornado insurance can be made equally successful with the proper restrictions and precautions. The provision for the payment of the premiums in advance in order to secure an ample reserve fund is as necessary as in the case of the fire companies cited above.

The next precaution to be taken should be the careful selection of risks. Risks should be well scattered across the wind lines rather than along them, and for this purpose the system of land surveying common in the Western States is admirably adapted. But one risk should be taken on a single section.[5] A township is too small and compact to be regarded as proper territory by a single company. Ranges of townships, or of fractions of townships, in a north and south line are far better adapted to this purpose. County tornado insurance companies should not be permitted to exist since the storm lines are far too long in relation to the size of the area.

Even these rules place several risks in the same storm line,

[5] Note on the term "section" for the information of European readers: The entire public domain of the United States is divided in accordance with a plan inaugurated in 1802 by Colonel Mansfield, then surveyor of the Northwestern Territory, into parts called *land districts*, each of which is put in charge of an official called a *surveyor general* who controls all the surveys in his district. In each district a meridian line is run, extending through the entire district, and from some point of this meridian an east and west line is run, which also extends through the district. These lines are determined astronomically, and when located serve as axes to which the subdivisions of the district are referred. Parallel to the axes, and on each side of them, other lines are run six miles apart, dividing the whole territory into squares, each containing 36 square miles. These squares are called *townships*. To take into account the obliquity of the meridians, suitable offsets are made in accordance with an established system. The townships lying between two consecutive meridians six miles apart constitute a *range*, and the ranges are numbered from the principal meridians both east and west. In each range the townships are numbered both north and south from the principal east and west line or *base line* as it is called. Thus, if a township lies twelve miles east of the principal meridian and eighteen miles north of the base line it is called township 3 north, range 2 east. Each township is divided by meridians and east and west lines into squares having a mile on each side. These are called *sections* and each contains 640 acres more or less. The sections of a township are numbered from the northeast corner, running along the northern tier of sections to No. 6, thence backward to No. 12, which lies exactly south of No. 1, and so on alternately running from right to left and from left to right to the southeasterly corner, which is No. 36. If the land is very valuable, the sections are divided into half sections by meridians and sometimes into quarter sections by lines running east and west, and these again into eighths by meridians. To designate one of these subdivisions, we say, for example, that it is the west half of the southwest quarter of section No. 16, township No. 7 north, range 3 west, and if necessary we add the name of the land district.—ED.

and should be still further limited in small local companies. A safe plan would be to place no more risks in positions such that all might be lost in a single tornado, than the company would be willing to carry as a single risk.

CONCLUSIONS.

Tornado insurance is a legitimate form of insurance and is a valuable protection in large portions of the United States. It now properly covers loss or damage from other windstorms since the distinction is a technical and scientific one. The business can be conducted on such sound principles and at such reasonable rates that it shall bring a just profit to the companies and at the same time give valuable protection, without burden to the insured.

This end can only be attained by the establishment of the business on a scientific basis, such as that on which fire insurance now rests. This basis is being approached by the better companies, but the end may be sooner reached by the active cooperation of those interested in insurance and meteorology.

The meteorologists working on the well-founded theories of Ferrel and along the lines of statistical research so well begun by Finley, Hazen, Henry, and Abbe could determine the hazard and predict the losses for all portions of the United States, preferably by unit areas within State lines.

The insurance companies could, by a careful separation of the windstorm business from the other forms of insurance with which it is now confused, also determine the hazard and predict the losses in the territory in which they are working. They could in addition predict the expenses and adjust the premiums accordingly.

Cooperation in this line would bring about a more equitable adjustment of rates, a general reduction of the cost of windstorm insurance, and increased security to both the companies and their patrons.

The Census Bureau could render most valuable assistance to this very important branch of business by again taking up the compilation of statistics on insurance so unfortunately omitted by the Twelfth Census.

The departments of insurance in the individual States could render great service by requiring careful reports on all tornado business, by enforcing certain necessary restrictions on the companies incorporated or operating within their States, and by recommending such legislation as would secure for their people insurance at the lowest cost consistent with safety to the insured and just remuneration to the insurer.

REFERENCES.

The following list of references will be found of value to anyone desiring to make a study of this subject. Those marked thus (*) have been found of special value in the preparation of this report:

*1. Ferrel, Wm.; Cyclones, Tornadoes, and Waterspouts. Professional papers, United States Signal Service, No. XII, pp. 51–59. Washington, 1882.

*2. Ferrel, Wm.; Recent Advances in Meteorology. Report of the Chief Signal Officer, 1885, Part II, pp. 287–334. Washington, 1885.

*3. Davis, W. M.; Whirlwinds, Tornadoes, and Cyclones. In Science, Volumes II and III, 1883–4, and separately. Boston, 1884.

*4. Hazen, H. A.; The Tornado. Science, Vol. XV, and separately. New York, 1890.

*5. Finley, J. P.; Characteristics of Six Hundred Tornadoes. Professional paper, United States Signal Service, No. VII. Washington, 1884.

*6. Finley, J. P.; Tornado Studies for 1884. Professional Paper, United States Signal Service, No. XVI. Washington, 1885.

7. Finley, J. P.; The Special Characteristics of Tornadoes, with Practical Directions for the Protection of Life and Property. United States Signal Service Notes, No. XII. Washington, 1884.

8. Finley, J. P.; Tornadoes. 12mo. New York, 1887. 196 pages.

*9. Finley, J. P.; State Tornado Charts. American Meteorological Journal, Vol. V, 1888, p. 466, etc.

10. Hinrichs, Dr. Gustavus; Tornadoes and Derechos. American Meteorological Journal, Vol. V, 1888–1889.

11. Henry, A. J.; Tornadoes. Monthly Weather Review, 1896.

*12. Abbe, Cleveland; Tornado Frequency per Unit Area. Annual Report of Smithsonian Institution, 1888, pp. 403–422. Monthly Weather Review, June, 1897, p. 250.

*13. The American Meteorological Journal, Ann Arbor, Mich.

*14. The Monthly Weather Review, United States Weather Bureau, Washington, D. C.

15. Fassig, O. L.; Bibliography of Meteorology, Part IV, Storms.

NORWAY'S CONTRIBUTIONS TO THE NATURAL SCIENCES.

By R. S. N. SARTZ. Dated Weather Bureau, Washington, D. C., October 25, 1905.

Norway, the land of the midnight sun, with scarcely two million inhabitants, can well be proud of her contributions to the world's progress in the past hundred years.

That the traditions of the old Vikings should still be able to inspire a Nansen and a Sverdrup to brave the dangers and seek fame and adventure by exploring the regions around the North Pole, as did their ancestors of old, seems natural enough. That the grandeur and beauty of the natural scenery, the almost incredibly brilliant coloring of the arctic night, where the midnight sun gives way to a moon so bright that one can read the finest printed book by its light, where the aurora borealis seems only an incident in the brilliantly illuminated heavens, should stimulate the imagination and create poets of high order, is easy to understand. Ibsen, Bjornsen, Garborg, Kjelland, Lie,[1] and others are the high priests of the Arctic, as are Grieg, Svendsen, and others its singers. They set to words and music a nature so grand that it would seem strange indeed if works, thus inspired, should not compare favorably with the literature and music of the rest of the world. But in the realm of exact science we should not expect to find the little country represented on the ladder of progress, and even at the very top.

It is, however, a fact that Norway has the distinction of having produced the two greatest mathematicians of the nineteenth century. Nils Henrik Abel, who was born August 5, 1802, and died in 1829, held the helm in the beginning of the century, and Sophus Lie (born in 1842, died in 1898) has been recognized as the greatest mathematical genius at the end of the same century. Abel's discoveries in the realm of algebra and Lie's in that of geometry are known to the scientific world, and we need but mention them here. Among other distinguished Norwegian scientists, we recall the following:

Christoffer Hansteen (1784–1873), the first professor of applied mathematics and astronomy in the University of Christiania, was, in his day, one of the most famous scientists of Europe. He explored Siberia, located the north magnetic pole and founded the Observatory of Christiania, thereby opening the way for the introduction into Norway of the then new branches of science, magnetism and meteorology.

Ole Jakob Broch (1818–1882), professor of pure mathematics in the University of Christiania, had a world-wide reputation in science, and was also a noted statesman and political economist. He was for many years a member of the Storthing (the Norwegian congress), and served a few years as secretary of the treasury. He was Norway's delegate to the International Monetary Conference at Paris, 1871, and made one of the best

[1] Pronounced "Lee."

received and most noted speeches in favor of the gold standard. His last ten years he spent in Paris, having been elected director of the International Bureau of Weights and Measures, located at Sevres. The physical data compiled by him for the first volume of the annals of that bureau were adopted as the basis of the international meteorological tables.

C. A. Bjerknes (1825–1903), professor of applied mathematics in the University of Christiania, was a contemporary and a collaborator of O. J. Broch, and his name must be mentioned whenever the history of natural science shall be written. His researches in the realm of magnetism and electricity attracted wide attention in the seventies and eighties. He wrote a very well received biography of Nils Henrik Abel, of whom he was a great admirer, having been active in calling the attention of his countrymen to the importance of the works of this profound genius. The results of his hydrodynamic researches are known as the C. A. Bjerknes Theory. His biography as published lately is a wonderful tale of struggle against disease and blindness.

Cato Maximilian Guldberg (1835–1902), Bjerknes' successor as professor of applied mathematics, was a versatile scientist. He is equally well known in the realms of astronomy, physics, and chemistry. In conjunction with his contemporary, Professor Waage, who conducted the chemical experiments, he applied the principles of mechanics to the phenomena of molecular attraction, supposed to exist between the smallest particles of matter, thereby practically raising the theory of chemical affinity and the science of chemistry from an experimental to an exact deductive stage. The results of his researches were first published in 1869 ("Études sur les affinités chémiques"), and his theory is known as the Guldberg-Waage-Law theory. Guldberg's style in his writings was brief and to the point. Together with Prof. Henrik Mohn, of Christiania, he published "Hvirvel Centrernes Theori (Études sur les mouvements de l'atmosphere"), a very important work on the fundamental principles of meteorology.

Axel Sofus Guldberg, a younger brother of the above, is the author of the text-book in astronomy now used in the University of Christiania. The spirit of the Norwegian astronomer is shown by the following quotation from the Bible: "Canst thou bind the sweet influences of the Pleiades or loose the bands of Orion?" (Job xxxviii, 31.)

Wilhelm Friman Koren Bjerknes, born 1862, son of Prof. C. A. Bjerknes, when a young student took deep interest in his father's hydrodynamic researches. He was a pupil of Poincaré at Paris, and Hertz at Bonn, and was very active in the work connected with the so-called Hertzian waves, succeeding in explaining some points in their theory that had till then been misunderstood. He took his doctor's degree in 1892 and has since 1895 been professor in the school for mechanics and physics of the Stockholm University. He has published "Vorlesungen über hydrodynamische Fernkräfte nach C. A. Bjerknes' Theorie." He is considered the highest living authority in the study of the mechanics of fluids.

Kristian Birkeland, born 1867, and professor of physics in the University of Christiania, has attracted attention by his researches on the origin of the northern light (aurora borealis). His "Recherches sur les taches du soleil et leur origine" sets forth his whole theory. He has made some important practical inventions. His invention of a method of utilizing atmospheric electricity for fertilizing purposes has been taken up by a stock company that has made some very successful experiments.

It was quite natural that a country with such an extended coast line, where the inhabitants mainly follow the sea for a living, should early awaken to the vital importance of meteorology to the safety of life. The Meteorological Institute at Christiania was established by Prof. Henrik Mohn, who still remains the head of that institution, where he has achieved many a meteorological triumph and has been the means of saving thousands of lives and millions in property. Before the establishment of the institution, about 1867, it was an almost yearly occurrence to have hundreds of fishermen and their boats destroyed by storms that even the experienced eye of the fisherman could not discover beforehand. Now such sad disasters are rarely heard of. To the Norwegian fisherman the Meteorological Institute is no joke; it is the one government institution he can endorse and feel grateful for.

Prof. Henrik Mohn, the first professor of meteorology in the University of Christiania and director of the Meteorological Institute, was born in 1835. He was the leader of the Norwegian Arctic Expedition, 1882–1883, the results of which were published in 1887. To him belongs the credit for having established meteorological stations as far north as possible, thereby contributing considerably to our meteorological knowledge of the globe. He also established a meteorological service for the Arctic Ocean, having secured the services of the captains of the Norwegian fishing vessels as voluntary observers. His treatise "Grundzüge der Meteorologie" (9th Ed. Berlin, 1883) has been translated into most modern languages and is considered a handbook of great value. Other publications by him are: "Temperature de la mer entre l'Irland, l'Ecosse et la Norvege," (Christiania 1870), "Oversigt over Norges Klimatologi" (Christiania 1870), and, together with Professor Guldberg, "Hvirvel Centrernes Theori," or "Études sur les mouvements de l'atmosphere." He has also just now edited the volume of meteorological results of Professor Nansen's Arctic Expedition.

A VISIT TO EUROPEAN OBSERVATORIES.

By GERALD J. O'CONNOR. Dated St. Louis, Mo., October 5–November 25, 1905.

A few observations made in the months of July and August, 1905, while touring in foreign lands, may be worthy of publication in the MONTHLY WEATHER REVIEW.

The itinerary included France, Italy, Switzerland, western Germany, Belgium, England, and Ireland.

While in London the opportunity was afforded me of visiting the Royal Observatory at Greenwich, from whose meridian longitudes are counted by nearly all nations. This observatory stands on an eminence about five miles southeast of London Bridge. A castle had been erected on this site in the reign of Henry V. During succeeding reigns it was occupied as a residence by members of the royal family, and in Queen Elizabeth's time it was used as a prison. In the reign of Charles II it was converted to its present use as an observatory, Sir Christopher Wren making the necessary alterations in 1675. The post of astronomer royal has been successively held by John Flamsteed, 1675–1719; Doctor Halley, 1720–1742; Doctor Bradley, 1742–1762; Nathaniel Bliss, 1762–1764; Doctor Maskelyne, 1765–1811; John Pond, 1811–1835; Sir George B. Airy, 1835 to 1881, when the present astronomer royal, Sir W. H. M. Christie, was appointed.

It was during the administration of Sir George B. Airy that the work was made to include meteorological observations and instruments for continuously recording atmospheric phenomena. Among instruments not ordinarily found at Weather Bureau stations in the United States is one for registering the pressure of the wind on a surface.

The central office for the collection and dissemination of weather information in France is at No. 176 Rue de l'Université, in Paris. Observations of temperature, precipitation, and wind direction and velocity are taken at a convenient time between 7 and 8 a. m., at fifteen stations within the city limits. One of these local observatories is at the summit of the Eiffel Tower; another in the tower of St. Jacques. I visited both of these. At the latter a daily map and forecast of "proba-

bilities" is issued. The map shows the weather conditions over France as determined from 25 stations, well distributed throughout the Republic. By means of a telegraphic cipher code, reports are received from stations at the capitals of almost all European nations, thus forming a network that sparsely covers the Continent.

At Rome there are at present four well-known observatories.

1. The weather service of Italy is a part of the Ufficio or Bureau of Meteorology and Geodynamics; its first chief, Professor Tacchini, recently died. Both meteorological and astronomical work are done at its station in the Collegio Romano, in Rome. I visited this observatory on July 11, having the honor to be presented by letter from the American Consul-General at Rome, Mr. Hector de Castro. Meteorological observations are here taken systematically and interchanged by telegraph daily with the capital cities and other important places in Europe. The instruments in use and the records of observations are essentially the same as those of the United States Weather Bureau. This observatory of the Collegio Romano was founded in 1550 by Julius III and rebuilt in 1582 by Gregory XIII (1572–1585) as a part of the famous Jesuit college. DeVico became director in 1838 and began effective astronomical work. It was rebuilt in 1853 under Secchi's directorate and devoted equally to meteorology and astronomy. It was while pursuing his labors here that the learned Jesuit Father Secchi became famous as a most zealous student of spectrum analysis, the branch of chemistry that reveals the constituent elements of the stars. His division of the stars into four types, according to variety and strength of the colored lines in their spectra, is but one of many works that will ever associate his name with astronomy. When the Jesuits were removed from this building in 1870, they established their college near by in the Borromeo Palace under a new name as the Pontifical Gregorian University; but Father Secchi, who had been in charge of the observatory since 1850, was allowed to remain in the Collegio Romano. After Secchi's death, in 1878, Millosevich was called from the Nautical Institute of Venice to take up the work at this observatory as a branch of the Central Office of Meteorology and Geodynamics. Thus, while retaining its old name, this observatory now belongs to the Government of Italy. Its latitude and longitude are 41° 53′ 53.6″ north, $0^h\ 49^m\ 55.55^s$ east from Greenwich.

2. The Observatory (established in 1827) of the Royal University (which was founded in 1303), located on the Campidoglio, and sometimes known as the Royal Observatory, or the Observatory of the Capitol. Here the astronomer Respighi made his observations of the solar spots. At present Prof. A. DiLegge is director and conducts both astronomical and meteorological work. Its latitude and longitude are 41° 53′ 33.5″ and $0^h\ 49^m\ 56.37^s$.

3. There is an observatory on the Janiculum, but its exact latitude and longitude I do not know. It is the personal property of Rev. A. Mueller, S. J., who is a professor in the Gregorian University. Only astronomical work is done here.

4. On July 13 I had the honor of visiting another famous observatory in Rome, that of the Vatican. For this rare privilege I was indebted to Monsignor Kennedy, Rector of the American Catholic College in Rome, and to Monsignor Uglione, Prefect of the Propaganda. After four days spent in viewing works of art, as displayed in the architecture, sculpture, and paintings in the various churches in the eternal city, it was indeed gratifying to me to gain admittance to a branch of the Vatican Palace that is devoted to the advancement of science. This observatory was founded in 1580 by Gregory XIII for astronomical work; in 1800 meteorological work was added. The late Pope Leo XIII labored incessantly after his accession in 1878 to establish an alliance between science and faith, believing there can be nothing fundamental in faith that is not consonant with demonstrated truth. He was installed in the chair of St. Peter at the time when the Rev. Father Peter Angelo Secchi had spread luster about the observatory of the Collegio Romano; this inspired an effort on Leo's part to modernize the analogous institution within the Vatican grounds by equipping certain apartments with the latest approved instruments for meteorological, astronomical, magnetic, and seismological work. The reorganized observatory began its work under the direction of Rev. F. Denza, and the first volume of the new series of observations was published in 1891. Denza died suddenly December 14, 1894, and his successor, Rev. Angelo Rodriguez y Prada, is now director.

This observatory, the Specola Vaticana as it is called in Italian, is located in the upper part of a building in the Vatican which in honor of its founder and to distinguish it from the building occupied by the Gregorian University, it is known as the Gregorian tower. It is a massive structure, rising considerably above most of the buildings that comprise the Vatican Palace, and containing many spacious apartments well adapted to meteorological and astronomical work. It was in one of these rooms (beautifully frescoed by the greatest artists of the time) that the commission, appointed by Pope Gregory XIII in 1582, reformed the calendar and made it obligatory throughout the Catholic world. During the three hundred years which have elapsed since that date the observatory has undergone numerous vicissitudes. Work in the astronomical department, which had been commenced so auspiciously and from which so much was expected, was gradually discontinued and all regular observations abandoned. Many efforts were made at various times to revive the institution, but it was not until the year 1887 that rehabilitation was undertaken. Father Denza, who had gained distinction as astronomer and philosopher, was placed in charge. Being of an inventive turn of mind he repaired and improved such of the instruments as had been neglected, and caused many new instruments to be installed. In 1888, on the occasion of the fiftieth anniversary of his elevation to the priesthood, Pope Leo perfected its entire rejuvenation; and in order that it might not again be exposed to the vicissitudes which had marked its previous history, his holiness endowed it with a sum ample to meet all current expenses. In a short time not only was the building renovated, but new instruments were installed and everything put in readiness for systematic and continuous observations. Two spacious rooms were reserved for meteorological instruments. In addition to the barometers, thermometers, anemometers, sunshine recorders, pluviographs, barographs, and thermographs, and such other instruments as are in use at Weather Bureau stations, there is also a self-recording psychrometer in design similar to the thermograph but having both wet and dry-bulb attachments. A wick connects the wet bulb with a vessel containing water on top of the cover of the instrument. A large heliograph and its appurtenances, used in photographing the sun, occupies the uppermost suite of rooms in the Gregorian tower. In addition to the rooms reserved in the tower for meteorological observations, certain portions of the Vatican gardens are set aside for experiments in terrestrial magnetism.

Another important addition to this observatory is a large photographic equatorial, in size and design like the great instrument in the National Observatory at Paris. This is located in the Leonine tower, about a quarter of a mile distant on the summit of the Vatican hill. Its internal diameter is about sixty feet and the walls at the base are not less than fifteen feet in thickness. The auxiliary apparatus used in connection with the equatorial is open to inspection as are also a number of other instruments including the seismograph. The structure is well adapted for the purposes of an observatory, being remarkably free from vibration and possessing a clear horizon. Both the Gregorian and the Leonine towers are now included in what is known as the Vatican Observatory.

In 1888 the astronomers of the Old World resolved to make a photographic map of the entire celestial sphere. Two series of observations were taken, one being a photographic reproduction of the starry vault, the other a new catalogue of position of stars greater than those of the twelfth magnitude. Father Denza took a great deal of interest in this work. Like his illustrious friend, Father Secchi, he was an ardent lover of nature and possessed a natural aptitude for the study of astronomy, meteorology, and the natural sciences. He was the founder of the Italian Meteorological Society and for more than a quarter of a century its director-general. Up to the time of his death in 1894, he contributed frequently to the meteorological journals of Europe.

The scientist who now presides is Rev. Angelo Rodriguez; he has a staff of seven assistants. The latitude and longitude of the Specola Vaticana are 41° 54′ 4.8″ north, and 0ʰ 49ᵐ 47ˢ east, as given in the American Ephemeris and Nautical Almanac; the last volume of the annals of the observatory on the Leonine tower gives the same longitude, but gives the latitude as 41° 54′ 16.7″.

The advantages of a great continental weather service, as reflected in the unqualified success of the United States Weather Bureau, have begun to be appreciated by all Europeans. It may be attributed to this that Professor Rodriguez is devoting more time than either of his distinguished predecessors to the meteorological department of the observatory; notwithstanding this he or one of his assistants is constantly at work with the great equatorial. In consequence of the existing relations between the Vatican and the Government of Italy, the observations and publications of the Vatican Observatory have no connection with the general meteorological service of Europe.

I can not conclude these remarks without special reference to the kindness of Professor Rodriguez. Although he could not speak English any better than I could speak Italian, yet, by reason of a certain familiarity with the subject, we managed to carry on an interesting conversation. He is a skilful observer and well versed in the principles of meteorology. To Professor Rodriguez I expressed the hope that I might find an opportunity to write a few lines appreciative of the Specola Vaticana. "Va bene" (go well) said he, and other words, which I interpreted to mean that he would be glad to know that the observatory of which he is director compares favorably with others I had seen in the Old World and the New.

RECENT ADDITIONS TO THE WEATHER BUREAU LIBRARY.

H. H. KIMBALL, Librarian.

The following titles have been selected from among the books recently received, as representing those most likely to be useful to Weather Bureau officials in their meteorological work and studies. Most of them can be loaned for a limited time to officials and employees who make application for them.

Austria-Hungary. I. R. Osservatorio Astronomico-Meteorologico di Trieste.
Rapporto annuale. v. 19, 1902. 107 pp. 4°. Trieste. 1905.

Bartholomew, J. G. (Ed.)
The survey gazetteer of the British Isles . . . 928 pp. 4°. London. 1904.

Batavia. K. Magnetisch en Meteorologisch Observatorium.
Regenwaarnemingen in Nederlandsch Indie. v. 26, 1904. vii, 469 pp. 4°. Batavia. 1905.

Bloxam, Charles Loudon.
Chemistry inorganic and organic, with experiments. 9th edition, revised by J. M. Thomson and A. G. Bloxam. xi, 872 pp. 8°. London. 1903.

Börnstein, R[ichard].
Unterhaltungen über das Wetter. 48 pp. 12°. Berlin. 1905.

Canada. Meteorological Service.
Report of the Meteorological Service of Canada for the year ended Dec. 31, 1903. xix, 384 pp. 4°. Ottawa. 1904.

Chambers, George F[rederick].
A handbook of descriptive and practical astronomy. 4th edition. 3 v. 8°. Oxford. 1889–1890.

Cowling, James.
Weather instruments for the home. 2d edition. 62 pp. 16°. New Jersey. 1904.

Fitzner, Rudolf.
Beiträge zur Klimakunde des Osmanischen Reiches und seiner Nachbargebiete. Part 1. Meteorologische Beobachtungen in Kleinasien 1902. 36 pp. 4°. Berlin. 1904.

Die Fortschritte der Physik. I, II, 1904. 8°. Braunschweig. 1904.

Geographisches Jahrbuch. 1905. 8°. Gotha. 1905.

Hann, Julius.
Lehrbuch der Meteorologie. 2d revised edition. xi, 642 pp. 4°. Leipzig. 1906.

Hedges, Killingworth.
Modern lightning conductors: an illustrated supplement to the report of the Lightning Research Committee of 1895 . . . vi, 119 pp. 4°. London. 1905.

International Geographic Congress, Washington, 1904.
Report. (58th Congress, 3d session, House doc. 460), 1064 pp. 8°. Washington, 1905.

Interstate Astronomical and Meteorological Conference, Adelaide, 1905.
Report. 11 pp. f°. Adelaide. 1905.

Kharkof. University. Meteorological Observatory.
Résultats des observations faites au nouvel observatoire météorologique de l'université de Kharkow. 1901. [Russian and French text.] iv, 131 pp. 8°. Kharkof. 1904.

Linke, F[ranz].
Luftelektrische Messungen bei zwölf Ballonfahrten. (Abhandlungen der königlichen Gesellschaft der Wissenschaften zu Göttingen. Math.-phys. Klasse. Neue Folge. Band III. Nro. 5.) 90 pp. 4 tables. 4°. Berlin. 1904.

Liznar, J[osephʰ].
Die barometrische Hohenmessung. 48 pp. 4°. Leipzig. 1904.

Marriott, William.
Hints to meteorological observers. Prepared under the direction of the council of the Royal Meteorological Society. 6th edition. 69 pp. 8°. London. 1906.

Mascart, E.
Traité de magnétisme. vi, 441 pp. 4°. Paris. 1900.

Miller, N. H. J.
Amounts of nitrogen as ammonia and as nitric acid and of chlorine in the rainwater collected at Rothamsted. (From the Journal of Agricultural Science. v. 1, pt. 3, Oct., 1905.) pp. 280–303. 8°. Cambridge (Eng.) [1905.]

Mysore. Meteorological Department.
Meteorology in Mysore for 1904 being the results of observations at Bangalore, Mysore, Hassan, and Chitaldrug. xv, 56 pp. 4°. Bangalore. 1905.

Schubert, J[ohannes].
Wald und Niederschlag in Schlesien. (Reprinted fr. Zeitschrift für Forst-und Jagdwesen. v. 37, pp. 375–380, June, 1905.) 8°. Berlin. 1905.

Soddy, Fredk.
Radio-activity: an elementary treatise from the standpoint of the disintegration theory. xi, 214 pp. 8°. London. 1904.

Sutton, J. R.
On the variation of the hourly meteorological normals at Kimberley during the passage of a barometric depression. (From the Transactions of the South African philosophical society. v. 16, pt. 2.) pp. 169–188. 4°.

Sutton, J. R.
Some results of observations made with a black bulb thermometer in vacuo. (From the Transactions of the South African philosophical society. v. 16, pt. 2.) pp. 79–96. 4°.

Tacubaya. Observatorio Astronomico Nacional de Tacubaya.
Annuario. 1906. 494 pp. 16°. Mexico. 1905.

Thévenet, [Antoine Francois].
Recherches sur la prévision du temps en Algérie. 71 pp. 8°. Alger. 1905.

Wade, E. B. H.
Report on the use of platinum resistance thermometers in determining the temperature of the air at Helwan Observatory. 24 pp. 4°. Cairo. 1905.

Voeikov, A[leksandr] I[vanovich].
Meteorology. [Russian text.] In 4 parts. XVII, 737, VII pp. 8°. St. Petersburg. 1903–04.

RECENT PAPERS BEARING ON METEOROLOGY.

H. H. KIMBALL, Librarian.

The subjoined titles have been selected from the contents of the periodicals and serials recently received in the Library of the Weather Bureau. The titles selected are of papers or

other communications bearing on meteorology or cognate branches of science. This is not a complete index of the meteorological contents of all the journals from which it has been compiled; it shows only the articles that appear to the compiler likely to be of particular interest in connection with the work of the Weather Bureau. Unsigned articles are indicated by a ——

Journal of the Franklin Institute. Philadelphia. Vol. 161. Jan., 1906.

—— Proper site for a windmill. P. 58.

Journal of the Meteorological Society of Japan. Tokyo. 24th year. Nov., 1905.

Wada, Y. L'observatoire coréen de Séoul et ses observations météorologiques. Pp. 9–14.

Nature. London. Vol. 73. Dec. 14, 1895.

—— Investigation of the upper air. [Announcement by the meteorological office.] P. 162.

Nature. London. Vol. 73. Dec. 21, 1905.

Shaw, W[illiam] N[apier]. The pulse of the atmospheric circulation. Pp. 175–177.

Nature. London. Vol. 73. Dec. 28, 1905.

—— Recent studies of periods in meteorology. Pp. 209–210.

Popular Astronomy. Northfield, Minn. Vol. 14. Jan., 1906.

Payne, W[illiam] W[allace]. The color of the sky. [Review of work by Thomas Curran Ryan.] Pp. 5–11.

Science Abstracts. London. Vol. 8. Dec., 1905.

B[utler], C. P. New method for determining the solar constant. [Abstract of article by Ceraski.] P. 676.

B[utler], C. P. Oscillations of solar activity and climate. [Abstract of article by C. Easton.] P. 676.

Scientific American Supplement. New York. Vol. 60. Dec. 23, 1905.

—— Old-fashioned weather glasses; how they are made. P. 25054.

Scottish Geographical Magazine. Edinburgh. Vol. 22. Jan., 1906.

Watermeyer, F. S. Geographical notes on South Africa south of the Limpopo. Pp. 29–38.

—— The Monte Rosa meteorological observatory. Pp. 43–44.

Symons's Meteorological Magazine. London. Vol. 40. Dec., 1905.

—— The relation between the circulation of the Atlantic and weather. [Abstract of article by W. Meinardus.] Fp. 201–202.

Goetz, E. The Bulawayo meteorological observatory. P. 205.

British Association Kite Committee. Report of the British Association Kite Committee. Pp. 206–208.

Annuaire de la Société Météorologique de France. Paris. 53 année. Nov., 1905.

Bruel, G. Notes sur la météorologie de la région du Chari. Pp. 233–251.

Garrigou-Lagrange, P. Les mouvements généraux de l'atmosphère en hiver. Pp. 254–257.

Brunhes, B[ernard]. Sur une modification de l'appareil de Shaw et Dines pour l'étude des variations brusques de pression barométrique. Pp. 253–254.

Archives des Sciences Physiques et Naturelles. Genève. 4 pér. Tome 20. Dec., 1905.

Arctowski, Henryk. Les vitesses maxima du vent enregistrées a la Tour Eiffel considerées en fonction de l'age de la lune. Pp. 687–691.

Bulletin de la Société Belge d'Astronomie. Bruxelles. 10 année. Nov., 1905.

Flamache, A. Les éclairs sans tonnerre. Pp. 293–296.

Bulletin de la Société Belge d'Astronomie. Bruxelles. 10 année. Dec., 1905.

Greville, Pierre de. La météorologie d'Alexandrie et de Beyrouth. Pp. 311–326.

Durand-Gréville, E. La loi des grains et des orages. Pp. 326–335.

Arctowski, Henryk. Les vitesses maxima du vent a la tour Eiffel et l'age de la lune. P. 349–352.

Ciel et Terre. Bruxelles. 26 année. 16 déc., 1905.

—— Les températures minima dans l'Afrique équatoriale du Sud. [Abstract.] Pp. 479–482.

Comptes Rendus de l'Académie des Sciences. Paris. Tome 141. 4 déc., 1905.

Nordmann, Charles. Sur certaines expériences relatives à l'organisation de l'atmosphère, exécutées en Algerie à l'occasion de l'éclipse totale du 30 août 1905. Pp. 945–948.

Houllier, —. De l'influence des pluies estivales sur le débit des sources de plaines. Pp. 972–973.

Platania, Gaetano and Platania, Giovanni. Effets magnétiques de la foudre sur les roches volcaniques. P. 974–975.

La Nature. Paris. 34 année. 16 déc., 1905.

Bellet, D. Le verglas et les voies ferrées électriques. Pp. 33–34.

La Nature. Paris. 34 année. 30 déc., 1905.

Jaubert, Joseph. Les brouillards dans la région parisienne. Pp. Pp. 78–79.

Le Temps qu'il Fait. Mons. 2 année. Déc., 1905.

Bracke, A. Dictions de fin d'année. Pp. 227–230.

Bracke, A. L'enseignement de la météorologie. P. 233–235.

Beiblätter zu den Annalen der Physik. Leipzig. Band 29. 1905.

G[erdien], H. Die kontinuierliche Registrierung der atmosphärischen Ionisation. [Abstract of article by Ch. Nordmann.] P. 1249.

G[erdien], H. Ein Registrierapparat für die Ionen der Atmosphäre. [Abstract of article by P. Langevin und M. Moulin.] P. 1249.

Meteorologische Zeitschrift. Wien. Band 22. Nov., 1905.

Hergesell, H[ugo]. Ballonaufstiege über dem freien Meere zur Erforschung der Temperatur und Feuchtigkeitsverhältnisse sowie der Luftströmungen bis zu sehr grossen Höhen der Atmosphäre. Pp. 481–586.

Hergesell, H[ugo]. Die Erforschung der freien Atmosphäre über dem Atlantischen Ozean nördlich des Wendekreises des Krebses an Bord der Jacht Seiner Durchlaucht des Fürsten vom Monaco im Jahre 2905. Pp. 487–439.

Hann, J[ulius]. Die temperature der Cyklonen und Anticyklonen. Pp. 490–495.

Less, E[mil]. Ueber die Wanderung der sommerlichen Regengebiete durch Deutschland. Pp. 496–505.

Rotch, L[awrence] and Teisserenc de Bort, L[eon]. Experimentelle Konstatierung der Existenz des Gegenpassates. Pp. 506–507.

Hann, J[ulius]. Resultate der meteorologischen Beobachtungen zu Cuyabá, Matto Grosso, Brasilien. Pp. 507–508.

H[ann], J[ulius]. R. Mossman über vorläufigen Ergebnisse der meteorologischen Beobachtungen während der schottischen antarktischen Expedition. Pp. 508–510.

Mossmann, Robert C. Zur Meteorologie der Laurie-Insel. Pp. 510–513.

—— Das Observatorium auf dem Monte Rosa. Pp. 513–514.

—— Prohaska über die Bearbeitung der einzelnen Gewitter. Pp. 514–516.

Reimann, —. Das Purpurlicht und der Diffraktionsring. Pp. 516–517.

Siegel, Franz. Resultate der meteorologischen Beobachtungen zu Curityba im Jahre 1904 1904. Pp. 518–519.

—— Prohaska über Zugrichtung, Stärke und Geschwindigkeit der Hagelwetter, Dauer des Hagelfalles 1902 und im Mittel. Pp. 519–523.

Okada (Tokyo). Ueber das Klima der Bonin-Inseln. Pp. 523–524.

—— William Ellis über die jahreszeitlichen Schwankungen der magnetischen Störungen. Pp. 524–525.

—— E. Marchand, Studien über die Wolken. Pp. 526–527.

Mitteilungen von Forschungsreisenden und Gelehrten aus den Deutschen Schutzgebieten. Berlin. 18 Band. 1905.

Thomas, —. Ergebnisse der meteorologischen Beobachtungen in Deutsch-Südwestafrika im Jahre 1903–04. Pp. 293–302.

—— Resultate der meteorologischen Beobachtungen in Swakopmund im Jahre 1904. Pp. 303–304.

Petermanns Mitteilungen. Gotha. Band 51. 1905.

Halbfass, W. Die Thermik der Binnen-Seen und das Klima. Pp. 219–233.

Das Wetter. Berlin. 22 Jahrgang. Dec., 1905.

Gallenkamp, W. Die Wärmestrahlung des Himmels. Pp. 265–277.

Hegyfoky, J. Zur tägliche Periode des Regens. Pp. 278–282.

Assmann, [Richard]. Die internationale Konference von Direktoren meteorologischer Institute in Innsbruck. Pp. 284–287.

Wiener Luftschiffer Zeitung. Wien. 4 Jahrgang. Dec., 1905.

Boltzmann, Artur. Untersuchung der Luftelektrizität vom Ballon aus. Pp. 239–241.

Arkiv för Matematik, Astronomi och Fysik. Uppsala. Band 2. N: o 4.

Holm, Ragnar. Ueber die abnorm kleine Sonnonstrahlung in den Jahren 1902 und 1903.

Arkiv för Matematik, Astronomi och Fysik. Uppsala. Band 2. N: o 7.

Grenander, S. Les gradients verticaux de la température dans les minima et les maxima barométriques.

Hemel en Dampkring. Den Haag. 3 Jaargang. Dec., 1905.

Nell, Chr. A. C. Het noorderlicht van 15 November 1905. Pp. 118–123.

Memorie della Società degli Spettroscopisti Italiani. Catania. Vol. 34. 1905.

Cirera, R. P. R. Rapport succinct sur l'Observatoire de l'Ebre. Pp. 225–228.

Ricco, A[nnibale]. Osservatorio solaire di Monte Wilson. Pp. 229–230.

NOTES AND EXTRACTS.

THE MILD WEATHER OF DECEMBER, 1905.

Several cooperative observers have called attention to the unusual mildness of the month of December, 1905. Thus Mr. Frank S. Jennison, who has kept a record for thirty years in Bangor, Me., reports the following figures as the average temperatures for the month of December for the last thirteen years.

Year.	6 a. m.	Noon.	6 p. m.	Mean.
	°F.	°F.	°F.	°F.
1893	12	21	16	16
1894	16	23	18	19
1895	16	28	22	22
1896	15	22	18	18
1897	16	30	16	21
1898	10	20	15	15
1899	20	32	22	25
1900	11	20	12	14
1901	11	21	13	15
1902	9	19	13	14
1903	11	21	13	15
1904	3	12	9	8
1905	16	30	23	23

The above-given mean of the three observations is probably a little higher than the true daily mean, but the comparison of successive years will not be affected thereby, so that December, 1899, must have been warmer than December, 1905.

The well-known observer and historian, Miss Ellen D. Larned, of Thompson, Windham County, Conn., writes as follows:

The mean temperature for 1904 footed up the lowest since my own or Doctor Caswell's observations began. The mild December of 1905 brought the mean annual temperature for that year nearly up to the average, viz: 45.56; the mean for 55 years is 46.

The twelve days of Christmas season December 25, 1905, to January 5, 1906, recalled the similar fine weather of 1829–30 for which I give the following record from the Larned diary, viz:

Saturday, December 25.—Dark morning. Sun comes out early. Fair and bright.

26.—Weather still fine.

27.—Weather still fine and warm. Cloudy and rainy evening.

28.—Dark morning. Sun came out warm as summer. Continued fine all day.

29.—Weather continues fine.

30.—Weather still warm and summer-like.

31.—Threatening morning. Cleared before noon. Another fine day.

1830. January 1.—Rather cooler but a most beautiful New Year's Day.

2.—Light snow in the night. Cleared soon. Another day as fine as the preceding.

3.—Fine, cloudless day. Nothing ever like it before.

4.—Another fine day.

5.—Cold and somewhat cloudy. Twelfth day of Christmas, all fine.

METEOROLOGY IN INDIA.

We venture to publish the following interesting items, mentioned in a letter of November 28, 1905, from Mr. Gilbert T. Walker, the Director of the Meteorological Service of India, to the Chief of the Weather Bureau:

Formerly it was necessary in a place like Lahore, Agra, Delhi, Karachi, or Rangoon to wait until 24 hours after the day's report and forecast were issued at Simla before the reports appeared in the papers; Calcutta, Bombay, and Madras each had a local office issuing a daily weather report. Now there is a daily telegram sent from Simla at 12:15 which goes "urgent" to most of the large cities and is posted up at the telegraph office.

There have also been large changes in consequence of the appointment of two Cambridge men (J. H. Field and J. Patterson) as assistants; they are both good experimental physicists. The former does the kite and balloon work and is attempting to follow in the footsteps of Professor Marvin in devising improvements in our instrumental equipment, while the latter is responsible for the daily weather work, the storm warnings, and the initiation of observations of solar radiation and atmospheric electricity.

We also have erected a splendid Japanese seismograph of the Omori-Ewing pattern, which is a great improvement on any that I have seen.

Field made a most successful beginning at Karachi[1] with kites. He had only a handgear (with some improvements for taking in slack wire) and got up through the monsoon winds into the calmer air above, which was not in sufficiently rapid movement to lift a kite far. He had not a breakaway or any appreciable accident in his seventeen flights, and promises to do extremely good work.

Balloons have very little chance of being found and returned in India. But as we want chiefly the direction and velocity of the currents at different heights, especially at considerable elevations, we have started at Simla[2] by observing with theodolites free balloons of gutta-percha tissue (which is much cheaper than India rubber here). We have experimented about five times, and usually get observations up to 25,000 feet above sea level; we hope to get up to about 33,000 feet shortly, but as the winds at that height are of about 35 to 45 miles an hour, the paper screen which is suspended from the balloon for purposes of visibility gets very hard to see after the balloon has been in the air for an hour, owing to the distance.

My personal investigations have been chiefly in connection with monsoon forecasting. I am sure to be badly wrong sometime, but hitherto I have been much more successful than I expected to be. Of my three forecasts last year and four this year, six have been right and one neither right nor wrong in the general character of the results, although in details improvements are very much needed.

The chief thing that has impressed itself on my mind has been the need of a satisfactory collation of facts, for they often run counter to the most natural preconceived view. For example, high pressure at Mauritius and good gradients thence to India are extremely bad for monsoon rainfall. I gave the figures in the Annual Summary for 1903 (concluding chapter),[3] and subsequent study has confirmed the view. Again high pressure in Siberia is favorable instead of unfavorable for the monsoon rains.

It seems to me, therefore, that for some time progress will lie in ascertaining what actually are the results of definite abnormalities of meteorological elements, and that it is not until more is known of them that it will be much good theorizing. Of course we must attempt to interpret each new fact in terms of what we know already, but it is not always easy to prove that the interpretation is correct as so little has been done in the way of recording the upper currents. One of the most interesting relationships is that of heavy snowfall in the Himalayas with increased ascensional movement at the equator on the south side. This year at the beginning of May the snowfall was the largest on record, so I telegraphed to Zanzibar and Seychelles for their April rainfall and found the former to be, as I had hoped it would be, the largest on record.

I find, however, that the winter snowfall is very hard to make much progress with. It seems to be related with the sun-spot data to some extent, in that heavy snow falls both at maxima and minima, as pointed out by Bradford. I have just noticed that here, as Woeikoff pointed out for Europe, the odd years tend to have more snow and rain than the even years; the average of the odd years is very materially larger than for the even ones.

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[1] On the coast at latitude 25° north, longitude 67° east.

[2] Elevation 7000 feet; latitude 31° north, longitude 77° east.

[3] By referring to the India Weather Review, Annual Summary, we find that the concluding summary occupies pages 649–661 and contains a résumé of the weather of the year, subdivided into: I. The cold weather period, January and February, 1903; II. Hot weather period, March to May, 1903; III. The southwest monsoon period, June to September, 1903; IV. Period of retreating southwest monsoon, October to December, 1903; and V. The year. Comparisons are made with previous years and in subdivision III the relations are discussed between rainfall and pressure gradients above referred to by Mr. Walker. The following deductions are made by him:

"The correspondence between rainfall and either the pressure gradients or the wind velocities at the Seychelles is not very clear. * * * The data for Mauritius yield the remarkable fact that the average pressure during the Indian monsoon period is lower in years of abundant rainfall than in years of scanty rainfall in India. The differences between the good and bad years are for June, .013 inch; July, .046 inch; August, .024 inch, and September, .018 inch.

"For Zanzibar the average pressure in the good years is lower than in the bad years by the following figures: June, .009 inch; July, .010 inch; August, .006 inch; and September, .035 inch. For the Seychelles the same result is true, the difference being—June, .019 inch; July, .039 inch; August, .013 inch; and September, .037 inch.

"The corresponding mean pressure in all India in the good years has a lower average than in the bad years by—June .008 inch, July .003 inch, August .002 inch, and September .029 inch. Thus the pressure difference between Mauritius and India, which might be regarded as measuring the force impelling the monsoon currents is less for the good years than the bad years by the following quantities: June, —.005 inch; July, —.043 inch; August, —.022 inch; and September, +.011 inch."

METEOROLOGICAL MAPS FOR SCHOOL USE.

The Chief of Bureau recently issued a circular to a number of prominent educators and Weather Bureau officials engaged in teaching meteorology and climatology, requesting an expression of opinion as to what charts and data are needed in connection with the study of meteorology and climatology by college and high school students. The replies received indicate a demand for laboratory material and for lecture material.

The material required for practise in the laboratory comprises blank maps of the world and of the various physical subdivisions; maps with temperature, pressure, or other data entered upon them, ready for drawing isotherms, isobars, etc.; blank forms for recording observations; tables of average climatic data, and of data for the construction of typical weather maps; and tables for the reduction of observations.

The illustrative lecture material for which a need is expressed extends over a wide range of subjects and includes charts and diagrams illustrating the distribution of the climatic elements, storm tracks, typical weather conditions, pictures of instruments, clouds, floods and rivers, storm destruction, snow and fog photographs, etc.

The demand for lecture material is not so much a call for new material as for the republishing of what is already at hand, but on a larger scale, in order that the charts, diagrams, and pictures may be hung up on the wall and be visible in a room full of students. The preparation of such a series would be very expensive, and will probably not be undertaken by any publishing house until there is a large popular demand.

In the way of laboratory material, the base maps used by the U. S. Weather Bureau have for some time been sold to schools for the use of students at very reasonable rates. These maps are, however, printed on paper specially adapted for printing, and are consequently not well fitted for pen and ink or pencil work. A small map used by the Weather Bureau draftsmen in preparing the charts for the MONTHLY WEATHER REVIEW has been directed by the Chief of the Weather Bureau to be printed in sufficient quantities to be supplied to schools for the use of students. It is without the hachures used on the other maps to indicate water surfaces, and shows only the more important stations, including those for which the daily observations are published in the annual report of the Chief of the Weather Bureau and those for which climatological data were published in the report for 1901–2. There is no legend on the map, except the scale of miles. The map is printed on two different grades of paper; the cheaper grade is suitable for ordinary classwork and can be supplied at about $2.50 per 1000; the better grade is suitable for the preparation of maps which are designed for school exhibitions or are to be preserved for other uses; maps on this quality of paper can be furnished at about $5.00 per 1000. On account of the cost of production these maps can not be furnished gratuitously.

For the study of the dynamics of the moving atmosphere on the rotating earth, the Editor has prepared polar projections of the northern and southern hemispheres, respectively, as seen from the north point; in which, therefore, both hemispheres appear as rotating in the same direction, not, as ordinarily printed, in opposite directions.—*C. A.*

THOMAS R. RODMAN.

By the death of Capt. Thomas R. Rodman December 18, 1905, we lose one of the best known cooperating observers, and a man who was also widely respected as a member of the Grand Army of the Republic and as a layman in the Episcopal Church.

Captain Rodman was born in New Bedford, Mass., September 27, 1825, and was the son of the late Samuel Rodman. After finishing an academic course in the Friends' Academy he entered Harvard College, graduating in 1846, when he became manager of his father's estate, which was quite an extensive one.

In the summer of 1862, then in his 37th year, at an age not to be carried away by excitement, but prompted to the performance of a duty which he felt belonged to every loyal citizen, he assisted his cousin, William Logan Rodman, in organizing a company for the 38th Massachusetts Regiment, a command which saw three years of hard service. He was commissioned captain of Company H, and his term of service expired July 11, 1865, at the close of the war. Port Hudson, Fishers Hill, and Cedar Creek were among the engagements in which the regiment participated.

Captain Rodman was always interested in weather observations, and for years kept up a record which his father started early in the nineteenth century. The following statement best illustrates the value of these observations:

My father, the late Samuel Rodman, began the record of temperature in October, 1812, at New Bedford, at the house on the northwest corner of Water and William streets. The position of the thermometer was at the east window of the second story and its elevation was about 30 feet above tide water.

On January 24, 1820, the location of the instruments was changed to the house on the northwest corner of Water and Middle streets. The position of the thermometer was at the northeast angle of the L of the house, and its elevation was about fifteen feet above tide water.

On January 19, 1828, the location of instruments was again changed to the house on the northeast corner of Spring and County streets, where it has been continuously maintained to the present time.

The first thermometer in this location, as I remember it, not very long after the date last mentioned, was on the pillars of the north portico of the house, where, by an arrangement of chains and hooks, it could be moved from side to side so as to escape the sun's rays. Its elevation in this position was about 108 feet above tide water.

At a subsequent date, which I can not now determine, the thermometer was removed to its present position in front of, and about eighteen inches from, the north window of the northwest room of the first story of the house. It is inclosed in a cage whose sides are of wood and whose front and back are of wire netting. The cage is suspended from an iron framework and is firmly held in place by iron braces. The elevation of the thermometer is about 106 feet above tide water. On each side of the window the blinds are bowed at right angles and permanently secured in this position so as to shield the instruments from the sun, and insulation is thus practically perfect.

The thermometer now in use is of the manufacture of J. Green & Sons, and its number is 2789. It was carefully selected by my father at a date which I am unable to establish. I am also unable to give the description and dates of the adoption of other thermometers prior to the selection of that now in use, but I am satisfied, from my own recollection and from my knowledge of my father's conscientious care in these matters, that the instruments employed in his meteorological work were the best obtainable. I know that he spared neither time nor money to obtain the best results.

The hours at which the thermometer was noted were: From October 1, 1812, to January 1, 1842, sunrise; 2 p. m.; sunset; 10 p. m. From January 1, 1842, to September, 1853, sunrise; 9 a. m.; 3 p. m.; 9 p. m. From September, 1853, to the present time, 7 a. m.; 2 p. m.; 9 p. m. These last hours were established to conform to blanks from the Smithsonian Institution.

My father died on August 1, 1876. Since his death, with some assistance from others for a year or two after his death, I have carried on the work.

This continuous series of observations, extending over a period exceeding 93 years, is a monument to the perseverance and faithfulness of these two men, father and son. The surviving members of the family state that they shall not be able to continue this important record any longer. Its termination at this time is a source of regret to those who have the advancement of meteorology at heart.

The city engineer of New Bedford has established and maintained a well equipped meteorological observatory, but the student of local climatology needs as many stations as possible; not one can be spared—least of all a station with a record for nearly a century under almost uniform conditions.

METEOROLOGY IN HOLLAND.

In 1853 the Royal Meteorological Institute of the Netherlands was established and for many years was under the direction of the famous Dr. C. H. Buys Ballot who at his death

in 1890 was succeeded by M. Snellen and he in turn by Prof. C. H. Wind as director in chief. In 1897 the institute was removed from Utrecht to its suburb De Bilt. According to a late number of Minerva the recent organization was as follows:

Director in chief—C. H. Wind.
Section directors—Dr. H. Ekama, Dr. J. P. Van der Stok.
Assistant directors—E. B. J. Kluit, Dr. C. M. A. Hartman.
Secretary—E. L. Olland.
Director of the branch in Amsterdam—L. Roosenburg.
Director of the branch in Rotterdam—A. E. Arkenbout-Schokker.

Under date of February 13, 1905, Prof. C. H. Wind announced that he had resigned his position as director in chief of the Royal Meteorological Institute of Holland, and that by a royal decree of February 13, 1905, Dr. E. van Everdingen is provisionally charged with the general management of the institute.

In October, 1905, Dr. Maurits Snellen announced that he should resign as director of the section in terrestrial magnetism and seismology of the Royal Meteorological Institute of the Netherlands, and that his future address will be Apeldoorn, Netherlands.

A LARGE METEOR.

A very large meteor is reported to have fallen in the water of Duck Thoroughfare near Atlantic City on the coast of New Jersey on October 3, 1905. Two fishermen stoutly maintain that the meteor fell within twenty feet of their boat, and it is said that many have been fishing for it with oyster tongs. On the other hand, this same meteor was seen rushing rapidly above many portions of Long Island during the night of the 3d–4th. The idea that it fell into the water on the coast of New Jersey is most likely to be an entire mistake. The Editor has known of cases in which persons ignorant of astronomy, and suddenly frightened by the appearance of a bright meteor overhead, have actually dodged or run to shelter, thinking it was coming straight for them; but the fact is that such objects are many miles away, and most frequently burn up entirely or split into many small fragments before they reach the earth; in fact, in many cases they pass entirely through the atmosphere and out into space.

It is very desirable that the public in general should endeavor to assist in the progress of our knowledge of meteors. Anyone may do this by merely recording and sending to the Editor a careful note as to the location of the apparent path of such a bright meteor. One has merely to say that it started at a certain altitude and azimuth, or at a certain bearing of the compass, and disappeared at a certain other bearing and apparent angular altitude; or one may say it started near a certain star, passed by certain other stars, and disappeared, always giving the time as accurately as possible. In some cases a most accurate record has been made by setting up stakes on the ground or making marks on the floor to show just where the shadow of a building or window was thrown. Do this promptly and let some surveyor measure the bearings for you. Observations of such bearings and altitudes made at different stations give us the basis for computing with much exactness the true distance and motion of the meteor. Perhaps 100 illustrations of such calculations may be found in the literature of science. Several such will be found in past numbers of the MONTHLY WEATHER REVIEW. See Volume XXII, page 128; Volume XXV, pages 56, 57, and 261.

Mr. William A. Carlson, of Victoria, Ill., writing under date of October 10, 1905, says:

> I wish to call attention to a large meteor which I saw fall on September 26, 1905. It came from the southwest and traveled at an angle of 60° from where I stood. It traveled thence to the northeast until it came directly east of me and then it started to fall; when it had fallen to an angle of 20° it exploded into three pieces; one piece fell to the south and one piece fell to the north, but the last and largest piece fell straight down. The meteor was much larger than the full moon.

WEATHER BUREAU MEN AS EDUCATORS.

Prof. A. G. McAdie, official in charge, San Francisco, Cal., reports that he attended the Thirty-first Annual Convention of Fruit Growers at Santa Rosa, Cal., and read a paper upon the influence of weather on crops, at the evening session of December 7, before an audience of about 300 fruit growers and representatives of the U. S. Department of Agriculture, the State University, the State Agricultural Society, and other bodies.

Mr. C. W. Ling, Assistant Observer, Havre, Mont., reports that on November 21, 1905, by invitation of the county superintendent of schools, he addressed the Teachers Institute of Chouteau County, Mont., on the work of the Weather Bureau.

By invitation of the official in charge many of the teachers visited the Weather Bureau office, and the meteorological instruments were explained to them.

Mr. I. M. Cline, District Forecaster, New Orleans, La., reports that Mr. H. F. Alciatore, First Assistant at that station, gave a lecture in the office on November 14, to a class of boys from the Live Oak Public School. The lecture lasted about one hour and included an explanation of the meteorological instruments used by the Weather Bureau and an account of the weather map and its use in forecasting.

Mr. J. P. Slaughter, Observer, Pueblo, Colo., reports that on October 24, 4 teachers and 31 pupils of the Fountain School of that city, visited the office and had the instruments, the weather map, and methods of forecasting explained to them.

Dr. O. L. Fassig, Research Director, reports that on December 4, 1905, he delivered a lecture on the climate and weather of Baltimore, one of a series of twenty lectures for the teachers of the Baltimore public schools, on the natural history of the environs of Baltimore. The course is being given under the auspices of the Woman's College of Baltimore. There were present about 300 subscribers to the course.

Mr. M. L. Fuller, Assistant Observer in charge, Charles City, Iowa, reports that the physical geography classes of the high school and of Charles City College, about 45 students in all, have visited the office in three sections, during the month of November. Each section received a 45 minute explanation of the station equipment and work.

Mr. Fuller has made an arrangement to give addresses on elementary meteorology and the work of the Weather Bureau before both the local high school and Charles City College.

Mr. N. B. Conger, Inspector and Marine Agent, Detroit, Mich., addressed the Detroit Engineering Society, by invitation, on the evening of November 24, 1905. The subject was the Weather Bureau and its work. Special attention was given to the data furnished by the Weather Bureau to engineers, the compilation of temperature and precipitation data, and the manner of issuing and distributing special warnings.

Mr. W. P. Stewart, Assistant Observer in charge, Escanaba, Mich., reports that the class in physics of the Escanaba High School visited the office in two sections on December 11 and 12 and were instructed in the construction and use of barometers, and the distribution of atmospheric pressure, including the formation and movement of areas of high and low pressure and their relation to the weather.

Mr. J. Warren Smith, Section Director, Columbus, Ohio, reports that on November 8, 1905, he delivered a half hour illustrated lecture at the Pan Handle Machine Shops in Columbus during the noon hour. The lecture was given at the request of the local branch of the Pennsylvania Railway Young Men's Christian Association.

The Chief of Bureau has received from Mr. L. M. Tarr, Local Forecaster, New Haven, Conn., a letter written by President Arthur T. Hadley, of Yale University, in which President Hadley expresses high appreciation of the work that Mr. Tarr is doing for the students of meteorology in Yale.

Mr. U. G. Purssell, Local Forecaster, Erie, Pa., gave an address before the Erie High School on December 19, 1905, on the organization, work, and practical benefits of the Weather Bureau. The audience was composed of the principal, teachers, and nearly seven hundred students.

At Albany, N. Y., a class of eight young ladies from St. Agnes's Academy visited the Weather Bureau office and Mr. George Todd, Local Forecaster, explained to them the instrumental equipment, charts, and map making.

During November and December, 1905, Mr. J. L. Bartlett, Observer, Madison, Wis., delivered six lectures on meteorological subjects, illustrated with the stereopticon, before various classes and organizations of the University of Wisconsin.

Mr. T. S. Outram, Section Director, Minneapolis, Minn., addressed the class in physical geography of the Minnesota State University, December 9, 1905, on the law of storms and methods of practical forecasting.

SPECIAL METEOROLOGICAL STATIONS FOR SPECIAL STUDIES.

A correspondent who is now studying botany at the Desert Botanical Laboratory of the Carnegie Institute, at Tucson, Ariz., writes as follows from his temporary location at Witch Creek, San Diego County, Cal., 116° 40′ west and 33° 5′ north, on the southwest slope of the San Jacinto Mountains, and about 50 miles northeast of San Diego:

I wonder if the Weather Bureau would not establish a few stations in this mountain country for observation of temperature, humidity, etc.; in short, make arrangements whereby the botanist, when he attempts to tell about the relations between plant societies and climatic conditions, may know what the conditions are. It would at the same time be a great boon to the health seeker. Two years ago I called on the official in charge of the San Diego station for the purpose of finding out something about humidity in the back country here. I was suffering greatly from rheumatism and needed the information, but there was absolutely none to be had. Following such advice as I could get, I came up here and found a good climate—no thanks to the Weather Bureau!

My notion is that if a good volunteer observer at each of a half dozen stations kept these records they would in a few years prove invaluable.

As soon as you get back a few miles from the sea, conditions begin to change, and by the time you reach Witch Creek, 50 miles from San Diego, you are in a climate not so dry as the desert, but intermediate between that and the climate of the coast. Suppose you had, right along this stage line, so that they could easily be supervised, observers at Ramona, 1000 feet; Witch Creek, 2400 feet; Julian, 4000 feet; and Banner, just over the ridge down in the desert; and one or two others, say at Mesa Grande (a fine fruit region), who would conscientiously keep these records—I believe that they would pay a large return.

I asked our postmaster here this morning if he had a rain gage. He answered with some pride that he had and that he always kept a record of the rainfall. The gage is a kerosene oil can. He said he would be glad to keep records as a volunteer observer if instruments and blanks for reports were furnished him. I have no doubt he would take much interest in the matter and, according to his lights, do it with scrupulous care. A gentleman at Mesa Grande, some miles from here, wants to keep such records, and went so far as to make application to the San Diego station a while ago for an outfit and instructions. The matter seems not to have gone any further. In a region like this, where the climate changes every few miles, there is great need of definite records. Such a chain of stations at these different altitudes and distances from the sea, beginning with San Diego and ending at Banner, would give data that it seems to me are absolutely necessary if we attempt to account for plant distribution and habits. They will not tell all, for the historical factor is to be reckoned with, but every substantial fact well established does throw a ray of light into the darkness.

I shall be here a month or two before going back to Tucson, and if the idea seems feasible I should be very glad indeed to help our postmaster here to get started with an actual rain gage and such other apparatus as it may seem best to provide him with; and I think I could help some others in the same way if it were decided to establish any more voluntary stations. I have had no special opportunities for doing this work myself, but I know what the botanists want. At present I am keeping records of relative humidity with Lambrecht's polymeter, but I presume some other form of psychrometer would be less liable to get out of order in the hands of an inexperienced observer.

A request like the above, from one entirely devoted to a special research, appeals very strongly to the Chief of Bureau and to all who wish to see every form of meteorological research properly supported. This is, however, only one of perhaps hundreds of similar requests received every year, and as Congress has made no special provision for anything more than the necessary increase of Weather Bureau forecast work and expenses, they must all be most regretfully denied.

The weather has an intimate relation to everything that goes on at the earth's surface; seismology, geology, botany, agriculture, milling, navigation, hygienics, commerce, astronomy represent only a small portion of the wide range of subjects that are forced upon the attention of the Weather Bureau. A few years ago it was said that the $10,000,000 given by Carnegie for scientific research would suffice, but the first year's experience showed that it could all be used up on any one of several branches of research. Similarly with the Weather Bureau—its resources are now wholly occupied in taking care of weather and river forecasts and crop reports. There are other great fields of human industry calling for assistance, but for the present it will be impracticable for the Chief to incur the expense of special stations that may be needed by special investigators. It was with great regret that he was obliged to abandon the expensive mountain stations on Mount Washington and Pikes Peak, which had contributed so much to the knowledge of the upper air. As our first duty is the study of the atmosphere, with a view to forecasting the weather, it is probable that the prosecution of mountain and balloon work is a more imperative duty than the study of dry desert regions. If the latter could contribute to our knowledge of the mechanics of the atmosphere to any such degree as do the highest mountains, then they might have a similar demand upon our attention. For the present, however, it would seem that the botanist and the sanitarian must look elsewhere for funds to maintain a few observers in the localities that specially interest them. The primary and fundamental duty of the Weather Bureau is the development of our knowledge of atmospheric motions and disturbances—not the average climate, but the daily weather.

With regard to the apparatus, the important instrument is that combination of wet-bulb and dry-bulb thermometers known as the psychrometer, and especially for real accuracy the whirled psychrometer in an instrument shelter as used by the Weather Bureau, or the sling psychrometer, or Doctor Craig's combination of shelter and sling, which is portable and less expensive. The Germans use the ventilated psychrometer invented by Assmann and manufactured by Fuess in Berlin. This instrument is highly convenient and very accurate. But the simplest instrument means an expense of probably at least $6 for the two thermometers, since they must be of the best

possible grade and their errors properly stated on an accompanying correction card, such as is furnished by the United States Bureau of Standards at Washington, at a very small expense. A complete Weather Bureau station is rarely needed for such special studies.

CYCLONES AND ANTICYCLONES.

The following article on cyclones and anticyclones was written in response to a request from a correspondent, apparently a small schoolboy, for some information about cyclones and anticyclones. As other young readers of the MONTHLY WEATHER REVIEW may also wish information on the subject, the reply is here published.

The atmosphere is an envelope or layer of gas that we call air covering the whole earth just as the peel covers an orange. It is unlike the orange peel in that it is free to move, like water. The air is, in fact, a sort of ocean that flows above us.

The air, like other gases, is compressible, and the lower layers of the atmosphere, which have to bear the weight of the upper layers, are much denser than the upper layers because the weight of these upper layers is pressing down upon the layers underneath, just as the hay at the bottom of a stack or the layers of wool at the bottom of a pile of fleece are more closely packed.

You can readily understand that a crab in the ocean or a crawfish in a pond must feel the differences in pressure as the waves of water go over him, especially in the shallow water on the seashore, where waves five or six feet high frequently pass over places that had only a few inches of water a moment before. The changes in the pressure of the air are not so sudden nor so extreme. The average pressure is about fifteen pounds to the square inch, and in extreme cases a change of only a pound or a pound and a half takes place in the course of a day.

The pressure of the air is measured with an instrument called the barometer (from two Greek words, *baros*, weight, and *metron*, measure), whence barometric pressure is spoken of, meaning pressure measured with the barometer, and as the barometer is only used to measure atmospheric pressure, barometric pressure is simply pressure of the air.

The barometer most commonly used is called the mercurial barometer and consists of a piece of glass tube about a yard long, closed at one end by melting the glass together. This tube is held open end up, and filled with mercury, and a small bowl is also filled with mercury. The tube is tightly covered with the finger, turned end for end, and the open end is put under the mercury in the bowl and the finger taken away. The mercury in the tube runs out into the bowl until about 30 inches of mercury remain in the tube, leaving at the top an empty space. The pressures of the mercury in the tube and the air outside balance each other, in just the same way as the columns of water in the two arms of a U-shaped tube balance each other. When the pressure of the air becomes less, the pressure on the surface of the mercury in the bowl becomes less, and some of the mercury runs out of the tube into the bowl. In this case the barometer is said to fall, meaning that the top of its column of mercury is lower. When the air pressure becomes greater, the pressure on the surface of the mercury in the bowl becomes greater, and the mercury runs back up into the tube. Then the barometer is said to rise, meaning that the top of the column is higher. These changes are measured by placing a piece of metal marked like a ruler or yardstick beside the tube of the barometer. This is called the scale of the barometer, and because the scale is divided into inches the pressure is spoken of as being so many inches of the barometer: the inches are subdivided into tenths and hundredths. On the weather map lines are drawn through all the places where the barometric reading is the same. There are other kinds of barometers besides the mercurial barometer. A kind very frequently seen is the aneroid barometer (aneroid from *a*, without, and *neros*, wet, without fluid), which consists of a small metal box with a spring inside. When the pressure becomes greater the sides of the box are pressed together, and when the pressure becomes less the sides are pushed outward by the spring. The sides are connected by a thread to a hand that moves around a dial like the face of a clock. Barometers can be made with water instead of mercury, but then the tube has to be about 30 feet high. A difference of an inch in the height of the mercury in the barometer corresponds to a difference of about a half a pound of pressure to each square inch.

You may have noticed little whirlpools in the water of a brook or river, where the bank juts out or where the current flows around a log or stone. Perhaps you have also noticed places where the water seemed to be boiling up from below, and wondered if there might be a whirlpool upside down that was causing the water to come up from the bottom. Whirlpools like these frequently occur in the atmosphere, for it is not still like the water in a pond, but is moving in great currents or streams like water in a canal or river. One such stream flows high above the ground over the Northern Hemisphere in the Temperate Zone and another over the Temperate Zone of the Southern Hemisphere. Both of these flow from west to east. The air over the tropical regions of the earth between these two streams of air is almost calm, except down at the surface of the ocean where the trade winds blow, in the Northern Hemisphere from the northeast toward the equator, and in the Southern Hemisphere from the southeast toward the equator.

You can see that the United States is under a stream of air flowing from the west by watching the high, thin clouds called cirrus or "mare's tails," which generally come from a westerly direction, either northwest, west, or southwest.

Whirls are formed in these aerial streams just as whirlpools and uprushes are formed in the rivers and brooks, but as the rivers of air are much larger than the rivers of water so the whirlpools of air are much larger than the whirlpools of water. The little whirlpools in the brook or river are generally only a few inches in diameter and last but a few minutes, while they are carried along a few feet or yards. The whirls that are formed in the air are of all sizes, the largest ones are sometimes so large that they cover several States and sometimes a third or half of the whole United States; they last for several days and even for a week or more and travel great distances, some having been known to travel almost around the earth.

These big whirls in the air are of two kinds; in one the air at the surface of the earth flows inward toward the center of the whirl, rises, and when it gets high above the ground flows outward from the center. This kind of whirl is called cyclone (from the Greek word *kuklos*, which means whirling around). The other kind of atmospheric whirl is more like the whirlpool in the river for in it the air comes down from above with a spiral movement and spreads out over the land. This is the anticyclone, so called because it is opposite to the cyclone in many ways (*anti* is a Greek prefix, meaning opposed to, or contrary to), as stated in the opposite paragraphs in the following comparison of the state of things near the surface of the earth:

In the cyclone—	*In the anticyclone—*
The wind blows spirally inward toward the center.	The wind blows spirally outward from the center.
The air pressure is lowest at the center, for which reason cyclones are also called "lows".	The air pressure is highest at the center, and anticyclones are called "highs".
The air in cyclones is warm, especially at the front.	The air in anticyclones is cold, especially at the front.
The weather in cyclones is cloudy and rainy.	The weather in anticyclones is clear and dry.

On the same side of the equator whirls of the same kind (cyclones for instance) always turn or rotate around their centers in the same direction. In our Northern Hemisphere the direction of the inward and upward spiral movement of the air circulating around a cyclone is always opposite to the direction of the movement of the hands of a watch or clock as it lies face upward, that is to say, contraclockwise. In the Southern Hemisphere, the whirling movement of cyclones is with the hands of a watch, or clockwise.

Anticyclones, contrary to cyclones in other respects, are also contrary to them in the matter of the direction of whirling. Anticyclones rotate clockwise in the Northern Hemisphere, and counterclockwise in the Southern Hemisphere. Of course there is a reason for this rule about the direction of whirling, and that is that the direction of the whirl is given to it by the direction of the whirling of the earth rotating on its axis.

If you have a stationary washbowl with an outlet at the bottom, or even a large round bottle turned upside down, you can make whirlpools for study by filling the bowl or bottle with water, and then when you pull out the stopper the water will start whirling around.

The broad aerial stream that is generally flowing from west to east over the United States apparently carries cyclones and anticyclones along with it very much as the brook or river carries along its whirlpools. It is this succession of "highs" and "lows" with their opposite kinds of weather and wind that brings us our frequent changes from rainy to clear, warm to cold, and south wind to north wind.

The word cyclone belongs to the very large whirls in the atmosphere that I have described. There are other smaller atmospheric whirls that have special names; these are the hurricane, typhoon, tornado, and waterspout. I wish especially to make very clear to you the difference between a cyclone and a tornado, because many people use the word cyclone when they mean tornado, and when others use the word cyclone properly they are not understood. The word cyclone was first used about the year 1840 as a name for very large whirling storms, sometimes as much as five hundred miles across, that occur in the Bay of Bengal and the Indian Ocean. Storms like these also occur in the West Indies (south and southeast of the United States), where they were named hurricanes by the Caribbean Indians who inhabited the islands of the West Indies when they were discovered by Europeans, and the name was adopted by the early Spanish and Portuguese navigators and has been used ever since. Storms of the same kind occur in the Philippines and on the Chinese coast, where they have been called typhoons from ancient times.

The name cyclone was invented to describe the whirling character of these large whirlwinds that Englishmen found in India. It was brought home to England by them, and the large whirling masses of air that are carried along from west to east were called cyclones, and now the word cyclone belongs properly to large whirlwinds two or three thousand miles in diameter.

The word tornado is a Spanish word meaning "twister," and is applied to the dangerous whirlwinds that tear down houses and kill people. They are very small compared with the hurricane and cyclone, being generaly less than half a mile in diameter and are rarely carried more than forty or fifty miles, and do not last altogether more than an hour or so before they die away and disappear. They take only a few seconds to pass over any given point. Cyclones and hurricanes travel for many days and go thousands of miles and take from a day to three or four days to pass over a place. It is evident, then, that the cyclone and the tornado are two very different things, their similarity being that they are both whirling masses of air. The house cat and the tiger are alike in more respects, but there is no one who would call a cat a tiger, so the tornado should not be called a cyclone.—*E. R. M.*

CORRIGENDUM.

MONTHLY WEATHER REVIEW for July, 1905, Vol. XXXIII, page 318, line 12: For "temperature over Iceland" read "pressure over Iceland."

THE WEATHER OF THE MONTH.

By Mr. WM. B. STOCKMAN, Chief, Division of Meteorological Records.

PRESSURE.

The distribution of mean atmospheric pressure is graphically shown on Chart VIII and the average values and departures from normal are shown in Tables I and V.

The mean pressure for the month was highest over the middle and northern Plateau and the western portions of the middle and northern slope regions, with the crest over southern Idaho, southwestern Wyoming, and northeastern Nevada. The contour of the isobars inclosing this area of highest mean pressure closely approached the normal for the month, but the values were considerably greater. The area of secondary normal high pressure overlying the region about the southern portion of the Allegheny Mountains is not indicated on the chart for this month.

The mean pressure was lowest over northeastern New England, the location and values being about normal. A secondary area of low mean pressure overlay southern Arizona and extreme southern California. The normal low pressure over the northern portion of the north Pacific coast region was displaced by the high pressure area to the southeastward.

The mean pressure for the month was slightly below the normal in the southern portion of the Middle Atlantic States, South Atlantic States, Florida Peninsula, southeastern half of the east Gulf States, northern upper Lake region, extreme northern portion of the upper Mississippi Valley, and eastern and central North Dakota; elsewhere the mean pressure was above the normal, with departures ranging from +.10 to +.20 inch over the greater portion of the slope and Plateau regions.

Over the entire United States the mean pressure for December exceeded that of the preceding month, except in the southern part of the Peninsula of Florida, where no change occurred.

The greatest increases occurred over the slope, Plateau, and middle and south Pacific districts, where they ranged from +.10 to +.26 inch, the extreme changes, +.20 to +.26 inch, occurring over southwestern Wyoming, northwestern Colorado, central and northern Utah, northern Nevada (the crest), northeastern California, and southern Idaho.

TEMPERATURE OF THE AIR.

The mean temperature for the month was above the normal from central Montana, northeastern Wyoming, and western Kansas eastward to the Atlantic Ocean; also in southern Virginia, northeastern North Carolina, southern Florida, extreme southwestern California, and extreme northwestern Washington. In the remaining portions of the country the mean temperature was below the normal. Except in the region bordering on the western and southern line of demarcation between the plus changes, and the western, northern, and eastern lines of minus changes the departures exceeded 2°. Over eastern Massachusetts, southeastern Upper Michigan, Minnesota, excepting the west-central portion, northwestern Iowa, southeastern Montana, southern and northeastern Nebraska, and extreme southeastern South Dakota, the excess amounted to +4°, or more, and over extreme southeastern South Dakot

the excess amounted to +6.3°. From eastern Alabama westward to eastern California, and over the middle slope and Plateau and the southern portions of the northern slope and Plateau regions, the deficiencies ranged from —4.0° to —11.6°; —6.0°, or more, over northwestern Louisiana, central and eastern Texas, and the middle slope and Plateau regions, and —11.6° over northern Nevada.

By geographic districts the temperature was normal in the north Pacific region; slightly below in the South Atlantic States, Florida Peninsula, Ohio Valley and Tennessee, middle slope, northern Plateau, and middle and south Pacific regions, and considerably below in the middle and southern Plateau and southern slope regions, and the Gulf States. In the Middle Atlantic States, upper Mississippi and Missouri valleys and northern slope region the mean temperature was slightly above the normal, and 2.0°, or more, above normal in New England, the Lake region, and North Dakota.

Maximum temperatures of 80°, or higher, were reported from the greater portion of the Peninsula of Florida, and of 70° to 80° at stations approximately 100 miles inland from the coasts of the South Atlantic and Gulf States, in the lower Rio Grande Valley, and from southwestern Arizona, and the southern third of California.

Freezing temperatures occurred, except over the greater portion of the Florida Peninsula, at places on the immediate coast of the west Gulf States, and in extreme southwestern Arizona, and extreme southwestern California.

Minimum temperatures of zero, or lower, were reported generally from the following districts: Northern portions of New England and New York, western Upper Michigan, Wisconsin, Minnesota, Iowa, north-central Missouri, northern Nebraska, the Dakotas, Montana, Wyoming, Colorado, northwestern New Mexico, northeastern Arizona, northern Utah, central and northern Nevada, and southeastern Idaho. Temperatures of —30° to —46° were reported from south-central Colorado.

The average temperatures for the several geographic districts and the departures from the normal values are shown in the following table:

Average temperatures and departures from normal.

Districts.	Number of stations.	Average temperatures for the current month.	Departures for the current month.	Accumulated departures since January 1.	Average departures since January 1.
		°	°	°	°
New England	8	31.8	+ 2.3	— 9.6	—0.8
Middle Atlantic	12	37.4	+ 1.9	— 3.8	—0.3
South Atlantic	10	46.0	— 1.9	— 2.2	—0.2
Florida Peninsula*	8	60.4	— 0.5	+ 6.6	+0.6
East Gulf	9	46.3	— 4.6	— 7.0	—0.6
West Gulf	7	45.6	— 5.8	— 6.5	—0.5
Ohio Valley and Tennessee	11	37.1	— 0.6	— 7.4	—0.6
Lower Lake	8	32.5	+ 2.0	— 7.7	—0.6
Upper Lake	10	27.4	+ 3.0	+ 1.0	+0.1
North Dakota*	8	15.8	+ 3.9	+13.5	+1.1
Upper Mississippi Valley	11	29.1	+ 1.7	— 2.3	—0.2
Missouri Valley	11	30.4	+ 1.8	+ 1.1	+0.1
Northern Slope	7	24.8	+ 0.2	+ 1.0	+0.1
Middle Slope	6	33.3	— 1.6	— 4.3	—0.4
Southern Slope*	6	37.4	— 4.0	—13.2	—1.1
Southern Plateau*	13	36.2	— 3.5	— 8.9	—0.7
Middle Plateau*	8	22.2	— 5.3	— 3.5	—0.3
Northern Plateau*	12	28.8	— 1.7	+ 7.5	+0.6
North Pacific	7	41.9	0.0	+ 7.7	+0.6
Middle Pacific	5	46.7	— 1.7	+ 6.6	+0.6
South Pacific	4	52.2	— 0.6	+ 4.5	+0.4

*Regular Weather Bureau and selected cooperative stations.

In Canada.—Prof. R. F. Stupart says:

Victoria, B. C., reports that the temperature was just average, but elsewhere throughout the Dominion the average was exceeded, and in most localities to a marked extent. In northern British Columbia the positive departure was 8°. In Alberta, Saskatchewan, and Manitoba it varied from 5° to 10°; in Ontario from 2° to 6°; in Quebec and the Maritime Provinces it was from 1° to 4°.

PRECIPITATION.

The distribution of total monthly precipitation is shown on Chart III.

The precipitation was above the normal in southwestern Maine, southeastern New Hampshire, off Rhode Island, in southern Connecticut, extreme southern New York, southern Pennsylvania, New Jersey, Maryland, District of Columbia, Virginia, North Carolina, except the extreme eastern part, South Carolina, Georgia, Florida, Alabama, extreme southern Mississippi, Louisiana, eastern and extreme western Texas, Tennessee, except the extreme southwestern part, Kentucky, the extreme southern portions of Indiana and Illinois, north-central Upper Michigan, and about the eastern end of Lake Ontario; elsewhere the precipitation for the month was below the normal.

Over the region from the District of Columbia southward over Florida and southwestward over southeastern Louisiana the excesses generally amounted to +2.0 inches, or more; +4.0 to +6.0 inches over western South Carolina and central Georgia; somewhat more than +10.0 inches over the extreme southeastern portion of Louisiana, and +8.4 to +12.4 inches over the southern third of the Peninsula of Florida.

As a rule, the deficiencies were less than —1.0 inch, except on the Pacific coast, where they ranged from —2.0 to —5.6 inches. Deficiencies of —1.0 to —2.0 inches were reported from Oklahoma, the northwestern portions of Arkansas and Missouri, west-central Mississippi, northeastern Illinois, northern Indiana, west-central Ohio, northeastern Wisconsin, and eastern Minnesota, and somewhat more than —2.0 inches from extreme northwestern Pennsylvania.

By geographic districts the precipitation for the month was slightly below the normal in the Lake region, North Dakota, upper Mississippi and Missouri valleys, northern and middle slope, and the Plateau regions, and 2.2 to 3.2 inches below the normal in the Pacific districts. The total for the month was slightly above the normal in New England, the Middle Atlantic and west Gulf States, Ohio Valley and Tennessee, and southern slope; nearly 3.0 inches above the normal in the South Atlantic and east Gulf States, and more than 6.0 inches above in the Florida Peninsula.

Average precipitation and departure from the normal.

Districts.	Number of stations.	Average.		Departure.	
		Current month.	Percentage of normal.	Current month.	Accumulated since Jan. 1.
		Inches.		*Inches.*	*Inches.*
New England	8	4.04	114	+0.5	— 5.7
Middle Atlantic	12	4.00	125	+0.8	— 2.5
South Atlantic	10	6.08	175	+2.6	— 6.7
Florida Peninsula*	8	8.84	348	+6.3	+ 8.1
East Gulf	9	7.28	159	+2.7	+ 4.0
West Gulf	7	3.82	115	+0.5	+ 2.5
Ohio Valley and Tennessee	11	3.67	120	+0.6	— 1.6
Lower Lake	8	2.14	75	—0.7	— 2.5
Upper Lake	10	1.30	59	—0.9	— 0.5
North Dakota*	8	0.14	26	—0.4	+ 0.2
Upper Mississippi Valley	11	1.19	63	—0.7	— 0.6
Missouri Valley	11	0.33	32	—0.7	+ 5.9
Northern Slope	7	0.13	25	—0.4	+ 2.6
Middle Slope	6	0.19	21	—0.7	+ 4.4
Southern Slope*	6	1.28	108	+0.1	+ 8.0
Southern Plateau*	13	0.81	80	—0.2	+ 7.8
Middle Plateau*	8	0.53	47	—0.6	+ 0.9
Northern Plateau*	12	0.95	54	—0.8	— 2.9
North Pacific	7	6.25	74	—2.2	—12.1
Middle Pacific	5	2.24	41	—3.2	— 9.0
South Pacific	4	0.33	11	—2.7	+ 0.8

*Regular Weather Bureau and selected cooperative stations.

The limit of snowfall extended as far south as southeastern North Carolina, central South Carolina, the northern third of Georgia, northern fourth of Alabama, extreme northern Mississippi, extreme northwestern Louisiana, and northern and western Texas.

The greatest amount of snow fell in northern Maine, Upper Michigan, northern Wisconsin, the central portions of Minnesota and North Dakota, and the middle and northern portions of the western mountains.

The total depth and the southern limit of snowfall are depicted on Chart X, and the depth of snow on ground at end of month on Chart XI.

In Canada.—Professor Stupart says :

The precipitation was deficient throughout Canada if we except a few isolated localities, as follows: Halifax, a positive departure of 1.5 inches; Chatham, N. B., 1.1 inches; Minnedosa, an excess of 0 2 of an inch, and Montreal 0.1 of an inch. The negative departures were in certain districts very pronounced. This was especially the case in Vancouver Island and over the lower mainland, Victoria recording a deficiency of 5.2 inches and New Westminster 3.5 inches. In the Northwest Provinces the precipitation, which was probably all snow, was very light, several localities reporting none. In Ontario the deficiency in precipitation was in many parts from 1 to 2 inches. In Quebec the rainfall was generally much below the usual amount, but on the other hand the snowfall was locally in excess of the average. In the Maritime Provinces Yarmouth was 2.0 inches below the average precipitation, and St. John 0.9 inch. At the close of the month there was no snow on the ground in southern Alberta; elsewhere in the Northwest Provinces, however, the covering was from 1 to 5 inches. In Ontario there was none in the southern parts, but 6 to 12 inches locally in the northern parts. In Quebec there was 10 inches in the western portion, increasing to 20 inches in the eastern portion. In the Maritime Provinces there was 12 to 16 inches in many parts of New Brunswick, diminishing to a few inches or more in southern Nova Scotia. In British Columbia there appears to have been a considerable quantity of snow on most of the mountain ranges.

HUMIDITY.

The relative humidity was normal in New England and the upper Mississippi Valley; slightly below the normal in the middle and South Atlantic and Gulf States, Ohio Valley and Tennessee, upper Lake region and middle slope; considerably below in the Missouri Valley, and much below in the middle and south Pacific regions. It was slightly above in the lower Lake region, North Dakota, middle Plateau, and north Pacific regions, and considerably above in the northern Plateau, southern and northern slope regions, and the Florida Peninsula, and much above in the southern Plateau region.

The averages by districts appear in the following table:

Average relative humidity and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
	%			%	
New England	76	0	Missouri Valley	71	— 4
Middle Atlantic	72	— 3	Northern Slope	74	+ 5
South Atlantic	76	— 2	Middle Slope	63	— 3
Florida Peninsula	86	+ 5	Southern Slope	73	+ 7
East Gulf	76	— 1	Southern Plateau	58	+12
West Gulf	73	— 1	Middle Plateau	73	+ 3
Ohio Valley and Tennessee	75	— 1	Northern Plateau	86	+ 6
Lower Lake	79	+ 1	North Pacific	87	+ 1
Upper Lake	81	— 1	Middle Pacific	71	—10
North Dakota	82	+ 3	South Pacific	61	— 8
Upper Mississippi Valley	78	0			

CLEAR SKY AND CLOUDINESS.

The cloudiness was above the average in New England, the Atlantic and east Gulf States, Florida Peninsula, Ohio Valley and Tennessee, southern slope, northern and southern Plateau, and the north Pacific regions. In the remaining districts it was below the normal.

The distribution of clear sky is graphically shown on Chart IV, and the numerical values of average daylight cloudiness, both for individual stations and by geographic districts, appear in Table I.

The averages for the various districts, with departures from the normal, are shown in the following table:

Average cloudiness and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
New England	6.0	+ 0.2	Missouri Valley	3.7	— 1.4
Middle Atlantic	5.8	+ 0.4	Northern Slope	4.5	— 0.1
South Atlantic	6.5	+ 1.8	Middle Slope	3.8	— 0.2
Florida Peninsula	7.2	+ 2.6	Southern Slope	4.7	+ 0.3
East Gulf	6.2	+ 1.0	Southern Plateau	3.2	+ 0.2
West Gulf	5.1	— 0.2	Middle Plateau	4.3	— 0.8
Ohio Valley and Tennessee	6.5	+ 0.4	Northern Plateau	7.4	+ 0.3
Lower Lake	7.2	— 0.4	North Pacific	8.3	+ 1.0
Upper Lake	6.6	— 0.5	Middle Pacific	5.3	— 0.1
North Dakota	5.0	— 0.2	South Pacific	3.4	— 1.0
Upper Mississippi Valley	4.7	— 1.0			

WIND.

The maximum wind velocity at each Weather Bureau station for a period of five minutes is given in Table I, which also gives the altitude of Weather Bureau anemometers above ground.

Following are the velocities of 50 miles and over per hour registered during the month:

Maximum wind velocities.

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
Atlanta, Ga.	10	50	nw.	Mount Weather, Va.	10	64	nw.
Block Island, R. I.	5	50	nw.	Do	23	61	nw.
Do	10	60	n.	Do	30	63	nw.
Do	21	62	e.	Nantucket, Mass.	10	64	n.
Do	30	60	w.	Do	21	59	e.
Buffalo, N. Y	11	60	sw.	Do	30	52	w.
Do	21	64	sw.	New York, N. Y.	4	53	nw.
Do	22	68	sw.	Do	10	64	nw.
Do	24	52	w.	Norfolk, Va.	21	52	w.
Do	29	71	sw.	North Head, Wash.	5	50	s.
Do	30	70	sw.	Do	12	50	s.
Cleveland, Ohio	30	50	sw.	Do	16	56	s.
Columbus, Ohio	29	56	sw.	Do	17	58	s.
Duluth, Minn	12	52	nw.	Do	18	62	se.
Eastport, Me.	3	50	ne.	Do	19	54	sw.
El Paso, Tex.	21	56	w.	Do	23	66	s.
Hatteras, N. C.	9	51	n.	Do	24	60	se.
Do	21	54	sw.	Do	25	75	s.
Do	31	58	n.	Do	26	60	s.
Jacksonville, Fla	20	51	sw.	Syracuse, N. Y.	30	50	sw.
Mount Tamalpais, Cal.	28	62	nw.	Tatoosh Island, Wash.	5	50	s.
Do	30	69	nw.	Do	19	52	sw.
Do	31	54	n.	Do	24	62	s.
Mount Weather, Va.	3	55	nw.	Do	25	60	s.
Do	4	62	nw.	Do	26	60	sw.
Do	5	53	nw.	Do	27	70	sw.

DESCRIPTION OF TABLES AND CHARTS.

By Mr. WM. B. STOCKMAN, Chief, Division of Meteorological Records.

For description of tables and charts see page 20 of REVIEW for January, 1905.

TABLE I.—*Climatological data for U. S. Weather Bureau stations, December, 1905.*

Stations.	Elevation of instruments.			Pressure, in inches.			Temperature of the air, in degrees Fahrenheit.										Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches.			Wind.					Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Total snowfall.
	Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hrs.	Departure from normal.	Mean max. + mean min. ÷ 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.					Total.	Departure from normal.	Days with .01, or more.	Total movement, miles.	Prevailing direction.	Maximum velocity. Miles per hour.	Maximum velocity. Direction.	Maximum velocity. Date.					
New England.							31.8	+ 2.3											76	4.04	+ 0.5								6.0		
Eastport	76	69	85	29.91	30.00	+ .02	28.0	+ 2.5	50	3	35	4	15	21	34		26	22	79	3.91	— 0.1	12	9,157	w.	50	ne.	3	7	5	19	7.1	18.1
Portland, Me.	103	81	117	29.92	30.05	+ .02	29.2	+ 1.8	48	28	37	7	15	22	27		26	21	76	5.44	+ 1.9	10	6,369	n.	38	nw.	10	9	9	13	5.7	14.8
Concord	288	70	79	29.74	30.06	— .00	28.4	+ 2.4	51	28	37	— 1	16	20	37		...	...	....	4.51	+ 1.2	10	3,762	nw.	27	w.	30	8	7	16	6.2	9.3
Northfield	876	16	70	29.08	30.07	+ .02	22.8	+ 1.4	50	3	33	— 18	15	13	41		20	18	84	2.64	— 0.1	13	4,940	s.	36	nw.	10	5	8	18	7.0	16.7
Boston	125	115	188	29.91	30.05	— .00	35.1	+ 4.0	61	3	43	8	15	28	28		31	25	69	3.23	— 0.2	8	8,352	w.	44	e.	21	11	6	14	5.8	3.5
Nantucket	12	14	90	30.03	30.04	— .01	38.4	+ 2.0	57	3	44	19	1	33	25		35	32	80	3.73	— 0.5	9	13,314	nw.	64	n.	10	10	6	15	6.1	0.5
Block Island	26	11	46	30.03	30.06	— .00	37.6	+ 1.4	60	3	43	16	1	32	24		35	31	78	4.03	+ 0.4	7	15,400	nw.	62	e.	21	10	10	11	5.7	T.
Providence	160	57	67	29.80	30.07	+ .01	34.6	.....	59	3	43	11	15	27	33		30	25	70	3.92	.....	8	5,780	w.	29	nw.	10	12	8	11	5.4	3.6
Hartford	159	122	132	29.90	30.08	+ .01	33.7	.....	58	3	42	7	15	26	33		30	25	74	3.47	.....	8	5,010	sw.	28	s.	2	10	10	11	5.8	3.6
New Haven	106	116	155	29.96	30.08	+ .01	35.3	+ 3.1	58	29	43	11	15	27	33		31	26	70	4.83	+ 1.4	7	7,227	sw.	37	e.	21	11	12	8	5.1	5.2
Mid. Atlantic States.							37.4	+ 1.9											72	4.00	+ 0.8								5.8		
Albany	97	102	115	29.38	30.09	+ .01	31.8	+ 3.2	57	29	39	7	16	25	28		28	24	75	1.36	— 1.4	8	5,084	s.	32	w.	29	8	8	15	6.7	2.1
Binghamton	875	79	90	29.11	30.07	— .02	31.5	+ 3.0	53	28	38	6	15	25	31		...	...	....	2.11	— 0.7	7	4,999	w.	34	se.	21	4	6	21	8.0	0.6
New York	314	108	350	29.74	30.09	.00	37.7	+ 3.3	57	3	44	19	1	32	24		34	29	70	3.67	+ 0.4	9	10,774	w.	64	nw.	10	8	12	11	5.7	0.7
Harrisburg	374	94	104	29.72	30.13	+ .01	36.0	+ 1.6	55	8	42	17	1	30	23		31	25	69	3.39	+ 0.4	9	5,897	w.	37	w.	30	11	9	11	5.2	0.4
Philadelphia	117	116	184	29.99	30.12	+ .01	39.2	+ 3.7	60	3	46	20	1	33	24		34	28	65	2.98	+ 0.2	11	8,698	sw.	48	sw.	21	12	6	13	5.4	2.8
Scranton	805	111	119	29.20	30.09	— .01	34.2	.....	54	29	41	12	15	27	27		30	25	73	2.38	.....	6	5,905	sw.	41	se.	21	3	17	11	6.7	0.5
Atlantic City	52	37	48	30.05	30.11	+ .01	38.7	+ 2.3	58	3	46	18	1	32	22		35	30	74	4.88	+ 1.0	11	7,022	w.	38	se.	21	11	3	17	6.0	T.
Cape May	17	48	52	30.11	30.13	+ .02	39.8	+ 1.9	58	3	45	17	1	34	22		36	...	....	5.33	+ 1.5	11	7,475	nw.	36	nw.	10	9	13	9	5.1	0.1
Baltimore	123	69	117	29.99	30.12	— .01	38.4	+ 0.9	60	8	45	20	1	32	24		33	27	66	4.32	+ 1.2	12	5,887	nw.	42	w.	30	12	4	15	5.7	5.7
Washington	112	59	76	29.99	30.12	— .01	37.5	+ 1.3	59	8	46	18	1	29	32		32	26	70	5.39	+ 2.4	10	5,110	nw.	38	nw.	10	14	7	10	4.8	5.4
Lynchburg	681	83	88	29.37	30.14	— .00	39.2	— 0.1	61	22	48	16	1	30	33		34	29	74	6.32	+ 3.3	11	3,284	sw.	28	nw.	10	15	6	10	5.1	4.3
Mount Weather	1,725	10	57	28.24	30.13	— .00	33.3	.....	52	12	39	12	1	27	23		28	22	68	4.12	.....	9	13,399	nw.	64	nw.	10	10	11	10	5.6	7.2
Norfolk	91	102	111	30.02	30.12	— .01	44.4	+ 1.6	68	21	52	27	1	37	27		39	34	73	3.98	+ 0.3	12	7,814	ne.	52	w.	21	12	5	14	5.8	1.0
Richmond	144	145	153	29.98	30.14	— .00	40.4	.....	62	12	48	20	1	32	28		...	...	....	7.10	.....	13	6,530	n.	41	sw.	21	15	5	11	5.1	1.3
Wytheville	2,293	40	47	27.69	30.16	+ .01	34.3	— 0.4	55	22	42	11	1	27	31		30	27	81	4.29	+ 1.5	14	4,777	w.	29	nw.	10	10	5	16	6.2	3.4
S. Atlantic States.							46.0	— 1.9											76	6.08	+ 2.6								6.5		
Asheville	2,255	53	78	27.73	30.17	+ .01	37.4	— 2.2	58	12	46	14	5	29	38		32	27	74	6.36	+ 3.4	11	6,731	nw.	38	nw.	10	10	6	15	6.2	1.3
Charlotte	773	68	76	29.29	30.15	— .01	49.9	— 2.7	62	22	48	23	5	34	30		36	31	73	6.56	+ 2.5	13	5,888	ne.	32	sw.	21	9	7	15	6.0	3.0
Hatteras	11	12	47	30.08	30.09	— .04	49.2	+ 1.0	70	3	55	33	5	43	25		46	43	82	5.28	— 0.2	13	13,391	ne.	58	n.	31	11	4	16	6.2	
Raleigh	376	71	79	29.72	30.14	— .01	42.4	— 1.5	63	22	51	22	1	34	32		37	32	74	6.52	+ 3.4	11	5,527	n.	36	nw.	10	13	4	14	5.3	5.0
Wilmington	78	81	91	30.01	30.10	— .05	47.4	— 0.9	74	23	56	26	5	39	29		42	38	76	5.51	+ 2.5	12	6,602	ne.	42	w.	21	10	7	14	6.0	
Charleston	48	14	92	30.06	30.11	— .04	49.6	— 1.9	69	20	57	30	5	42	24		45	41	78	4.24	+ 1.0	13	9,079	n.	48	ne.	8	7	1	23	7.6	
Columbia, S. C.	351	41	57	29.74	30.13	— .03	44.6	— 3.3	68	23	52	25	5	37	31		39	34	72	7.34	+ 4.4	11	5,819	ne.	30	sw.	21	7	9	15	6.6	
Augusta	180	89	97	29.94	30.14	— .02	45.4	— 2.3	69	23	53	26	5	38	31		40	36	76	8.08	+ 4.7	13	5,248	ne.	26	ne.	8	8	8	15	6.5	
Savannah	65	81	89	30.04	30.11	— .04	49.6	— 2.8	75	23	57	29	5	42	27		44	40	76	5.24	+ 2.0	14	5,990	n.	41	sw.	20	9	2	20	7.2	
Jacksonville	43	101	129	30.03	30.08	— .06	53.5	— 2.5	78	20	61	35	4	46	25		50	47	83	5.65	+ 2.8	15	7,367	n.	51	sw.	20	4	6	21	7.5	
Florida Peninsula.							65.8	— 0.4											86	10.12	+ 3.0								7.2		
Jupiter	25	10	48	30.00	30.03	— .07	67.0	+ 0.3	83	3	73	49	18	61	21		64	62	86	15.18	+12.4	26	10,211	nw.	38	e.	1	1	13	17	7.7	
Key West	22	10	53	29.99	30.01	— .07	70.2	+ 0.2	84	3	74	59	26	66	15		66	65	86	10.03	+ 8.4	18	8,874	ne.	37	nw.	3	4	8	19	7.5	
Tampa	35	79	96	30.02	30.06	— .06	60.2	— 1.7	78	23	68	40	11	52	27		56	53	86	5.14	+ 3.3	10	6,736	ne.	40	w.	29	8	6	17	6.4	
East Gulf States.							46.3	— 4.6											76	7.28	+ 2.7								6.2		
Atlanta	1,174	190	216	28.87	30.13	— .03	42.2	— 3.1	65	22	49	21	4	35	26		38	33	76	9.54	+ 5.4	13	10,498	nw.	30	nw.	16	9	7	15	6.3	0.2
Macon	370	55	66	29.74	30.14	— .02	45.4	.....	70	22	54	26	5	37	31		...	...	....	7.44	.....	13	4,101	ne.	24	ne.	9	7	5	19	6.7	
Pensacola	56	79	96	30.06	30.12	— .03	50.5	— 4.0	70	2	58	30	25	43	25		...	...	....	7.41	+ 3.5	9	8,684	n.	48	sw.	31	9	4	18	6.3	
Birmingham	700	136	144	29.36	30.14	— .02	43.4	— 4.8	66	22	50	22	4	37	29		...	...	....	5.21	+ 0.1	14	6,518	n.	48	se.	28	6	10	15	6.8	
Mobile	57	98	96	30.06	30.12	— .03	49.6	— 2.8	70	21	58	31	4	42	24	44	40	76	7.02	+ 2.6	13	4,519	n.	27	e.	28	8	9	14	5.8	
Montgomery	223	100	112	29.89	30.15	— .01	45.3	— 4.3	68	22	53	25	5	38	28	41	37	78	5.98	+ 1.3	12	5,558	nw.	32	e.	19	9	7	15	6.0	
Meridian	375	84	93	29.74	30.15	— .01	43.2	— 7.3	72	22	52	23	25	34	32		...	...	....	4.64	— 0.6	12	4,625	e.	28	e.	19	11	3	17	6.4	
Vicksburg	247	62	74	29.86	30.15	— .00	45.1	— 5.5	70	22	53	29	5	38	26	40	34	72	3.98	— 1.0	9	5,316	n.	33	e.	19	12	5	14	5.7	
New Orleans	51	88	121	30.06	30.12	— .01	50.8	— 4.7	75	22	58	33	5	44	25	46	42	76	14.43	+10.1	12	7,651	n.	42	se.	19	9	6	16	6.0	
West Gulf States.							45.6	— 5.8											73	3.82	+ 0.5								5.1		
Shreveport	249	77	84	29.90	30.18	+ .05	43.2	— 6.3	60	22	50	29	17	36	25	39	33	73	5.10	+ 0.4	12	4,934	nw.	28	se.	27	13	5	13	5.4	1.1
Fort Smith	457	79	94	29.67	30.16	+ .03	39.4	— 3.4	57	25	48	22	11	31	34	34	28	69	2.17	— 1.0	8	5,320	e.	27	w.	28	13	5	13	4.9	T.
Little Rock	357	93	100	29.79	30.18	+ .04	40.0	— 5.0	58	25	47	25	11	33	31	36	31	74	5.34	+ 1.0	12	4,769	nw.	28	n.	14	15	4	12	5.1	3.5
Corpus Christi	20	48	53	30.12	30.14	+ .02	52.8	— 6.5	72	21	60	32	25	45	28	48	43	74	2.34	+ 1.0	11	6,380	n.	27	se.	18	14	7	10	4.9	
Fort Worth	670	106	114	29.44	30.17	+ .05	42.5	.....	64	27	51	27	10	34	31		...	...	....	3.60	.....	9	6,379	nw.	33	nw.	22	16	8	7	4.5	T.
Galveston	54	106	112	30.68	30.14	+ .02	51.6	— 5.5	70	1	57	38	15	46	22	49	46	84	5.32	+ 1.3	9	9,286	nw.	34	n.	2	14	5	12	5.1	
Palestine	510	73	79	29.60	30.14	+ .02	43.8	— 7.6	62	22	52	29	5	36	26	38	33	72	4.88	+ 1.1	11	5,424	n.	23	ne.	13	13	4	14	5.5	T.
San Antonio	701	80	91	29.40	30.14	+ .03	48.5	— 6.4	74	21	58	29	31	39	30	41	34	65	1.56	— 0.4	8	5,260	nw.	32	nw.	22	15	4	12	4.9	
Taylor	583	55	63	29.52	30.14	+ .03	45.6	.....	69	21	55	27	4	37	30		...	...	....	2.99	.....	9	5,758	n.	27	n.	9	12	7	12	5.5	
Ohio Val. and Tenn.							37.1	— 0.6											75	3.67	+ 0.6								6.5		
Chattanooga	762	106	112	29.34	30.17	+ .01	41.8	— 1.8	61	22	49	21	4	34	27	37	31	70	6.29	+ 2.0	15	5,570	ne.	34	nw.	10	10	6	15	6.1	T.
Knoxville	1,004	35	88	29.07	30.16	— .00	39.8	— 0.1	58	22	48	18	5	32	28	35	30	72	5.16	+ 1.0	13	5,581	sw.	40	sw.	29	9	2	20	7.0	1.0
Memphis	399	76	97	29.75	30.19	+ .04	41.2	— 2.4	59	27	47	24	4	35	23	37	32	74	3.99	— 0.2	13	7,238	n.	44	sw.	28	10	4	17	6.3	0.1
Nashville	546	79	91	29.58	30.18	+ .03	40.2	— 1.5	58	11	47	21	4	33	28	35	30	71	4.15	+ 0.4	11	4,332	sw.	28	sw.	21	11	2	18	6.3	T.
Lexington	989	75	102	29.05	30.16	+ .02	35.3	— 3.3	50	9	41	18	24	29	22		...	...	....	4.13	+ 0.7	10	8,680	sw.	46	sw.	29	8	6	17	6.4	6.9
Louisville	525	111	132	29.57	30.17	+ .03	37.2	— 1.2	55	9	44	18	24	31	24	33	28	73	5.48	+ 1.6	9	6,969	sw.	38	sw.	29	7	8	16	6.5	2.7
Evansville	431	72	82	29.68	30.16	+ .03	37.0	.....	54	11	43	17	4	31	22		...	...	....	3.44	.....	8	5,885	sw.	33	sw.	28	9	10	12	5.6	T.
Indianapolis	822	154	164	29.22	30.13	+ .01	33.5	+ 0.4	52	8	40	10	24	27	20	29	25	75	2.20	— 1.0	8	8,438	sw.	40	sw.	29	9	9	13	6.1	0.4
Cincinnati	628	152	160	29.45	30.15	+ .02	36.3	— 0.3	54	9	43	16	24	30	24	32	27	72	2.81	— 0.3	10	5,844	sw.	33	sw.	29	8	6	17	6.5	2.4
Columbus	824	173	190	29.22	30.13	+ .01	34.2	+ 0.9	51	7	40	16	4	28	25	31	28	81	1.87	— 1.0	13	9,351	sw.	56	sw.	29	9	7	15	6.0	1.1
Pittsburg	842	336	352	29.20	30.13	+ .02	35.2	+ 0.2	58	28	42	16	4	28	26	31	27	77	3.02	+ 0.1	11	8,977	sw.	49	w.	30	5	10	16	7.2	2.0
Parkersburg	638	77	84	29.47	30.15	+ .01	36.2	— 0.4	52	12	43	17	25	29	25	33	29	79	2.65	— 0.1	13	4,604	sw.	29	w.	29	5	4	22	7.7	1.3
Elkins	1,940	41	50	28.03	30.17	+ .05	34.2	+ 1.9	54	2	42	7	1	26	33	29	25	79	2.29	— 1.9	12	3,901	w.	28	se.	28	8	5	18	7.0	3.9
Lower Lake Region.							32.5	+ 2.0											79	2.14	— 0.7								7.2		
Buffalo	767	178	206	29.20	30.06	.00	32.7	+ 2.9	51	28	38	12	15	28	20	30	27	80	3.07	— 0.3	20	15,187	sw.	71	sw.	29	4	8	19	7.4	8.9
Oswego	335	76	91	29.68	30.06	.00	31.0	+ 1.6	50	29	37	3	15	25	23	29	26	84	3.71	+ 0.3	15	8,781	s.	43	w.	30	3	4	24	8.2	10.8
Rochester	523	81	102	29.49	30.08	+ .02	32.4	+ 3.8	53	28	38	10	1	27	25	29	25	78	2.85	— 0.1	13	7,442	sw.	37	sw.	30	4	6	21	7.8	8.4
Syracuse	597	97	113	29.41	30.07	.00	31.2	.....	51	29	37	2	15	25	26		...	...	....	3.21	.....	13	9,153	sw.	50	sw.	30	5	7	19	7.1	12.7
Erie	713	92	102	29.28	30.07	.00	33.2	+ 0.8	53	28	38	13	15	28	21	30	24	71	0.95	— 2.3	12	10,113	sw.	39	se.	21	7	3	21	7.6	6.3
Cleveland	762	190	201	29.24	30.09	.00	33.1	+ 1.9	51	28	38	16	4	28	22	30	26	77	1.72	— 0.9	15	11,944	sw.	50	sw.	30	6	7	18	7.2	4.8
Sandusky	629	62	70	29.39	30.09	.00	33.2	+ 0.7	51	7	39	17	4	28	23		...	...	....	1.58	— 0.9	10	7,009	sw.	33	w.	30	9	4	18	6.5	0.9
Toledo	628	120	127	29.39	30.10	+ .02	32.4	+ 1.7	51	8	38	14	3	26	23	29	26	79	1.56	— 0.8	10	8,948	sw.	37	w.	30	13	4	14	5.9	3.5
Detroit	730	153	193	29.26	30.08	+ .01	32.0	+ 2.5	48	8	37	16	4	27	21	30	27	84	1.72	— 0.8	9	9,765	sw.	38	w.	29	6	8	17	7.0	4.8
Upper Lake Region.							27.4	+ 3.0											81	1.30	— 0.9								6.6		
Alpena	609	13	92	29.32	30.01	— .01	28.6	+ 3.8	47	7	34	9	1	23	24	27	24	83	1.70	— 0.8	11	7,496	sw.	37	se.	1	5	9	17	7.0	11.1
Escanaba	612	40	48	29.32	30.01	— .02	25.8	+ 4.4	48	7	33	1	14	19	24	24	20	79	1.63	— 0.3	9	5,290	sw.	28	nw.	9	7	9	15	6.2	11.0
Grand Rapids	707	127	165	29.27	30.06	+ .01	30.4	+ 1.7	48	8	36	14	4	25	22	29	26	85	1.13	— 1.7	13	8,980	sw.	38	w.	10	7	3	21	7.1	5.3
Houghton	668	66	74	29.23	29.98	— .04	25.2	.....	46	17	32	0	14	18	27		...	...	....	2.46	.....	15	4,462	w.	24	n.	21	7	6	18	7.1	24.7
Marquette	734	77	116	29.16	29.99	— .03	26.6	+ 3.8	49	7	33	6	14	21	22	24	29	78	3.12	+ 0.7	16	7,795	w.	36	sw.	17	8	8	15	6.5	27.8
Port Huron	638	70	120	29.34	30.05	— .01	30.3	+ 2.5	48	8	36	13	15	25	19	28	26	85	1.10	— 1.2	7	9,353	sw.	42	w.	30	8	1	22	7.0	3.7
Sault Ste. Marie	614	40	61	29.28	30.00	— .00	24.9	+ 2.3	42	7	31	4	14	19	26	24	22	85	1.16	— 0.9	12	6,720	se.	38	nw.	30	0	5	26	8.7	11.0
Chicago	823	140	310	29.18	30.10	+ .02	31.8	+ 2.5	52	8	38	7	24	26	18	29	26	78	0.68	— 1.7	9	11,663	sw.	46	w.	29	13	5	13	5.2	2.8
Milwaukee	681	122	142	29.32	30.08	+ .02	29.4	+ 3.8	52	8	36	6	24	23	20	27	22	75	1.46	— 0.5	8	7,279	w.	33	se.	1	13	2	16	5.8	6.8
Green Bay	617	49	86	29.34	30.03	— .01	25.8	+ 2.0	45	7	33	— 1	24	19	23	24	20	79	0.97	— 1.0	6	7,789	sw.	33	w.	29	8	3	20	7.2	4.3
Duluth	1,133	11	47	28.74	30.01	— .04	19.9	+ 2.9	41	7	27	— 4	13	13	24	18	15	84	0.07	— 1.3	2	10,886	sw.	32	nw.	12	10	14	7	5.0	0.9

TABLE I.—*Climatological data for U. S. Weather Bureau stations, December, 1905*—Continued.

Stations.	Elevation of instruments.			Pressure, in inches.			Temperature of the air, in degrees Fahrenheit.										Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches.			Wind.				Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Total snowfall.
	Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hrs.	Departure from normal.	Mean max. + mean min. ÷ 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.					Total.	Departure from normal.	Days with .01, or more.	Total movement, miles.	Prevailing direction.	Maximum velocity. Miles per hour.	Maximum velocity. Direction.	Maximum velocity. Date.				
North Dakota.							**15.7**	**+ 2.5**								**82**			**82**	**0.14**	**— 0.5**								**5.0**	
Moorhead	940	8	57	29.01	30.08	.00	14.6	+ 2.7	38	10	23	—14	3	6	31	14	13	93	0.30	— 0.4	4	6,031	nw.	28	se.	1	16	2	13	4.5	3.2
Bismarck	1,674	15	57	28.24	30.11	+ .03	16.8	+ 2.1	41	25	24	—16	3	9	30	14	7	67	0.08	— 0.6	1	6,516	nw.	44	nw.	17	14	9	8	4.8	0.8
Devils Lake	1,482	11	44	28.38	30.03	— .03	13.9	.....	40	25	23	—21	3	5	36	12	9	80	0.07	.....	5	7,379	sw.	45	nw.	17	8	9	14	6.1	0.7
Williston	1,875	14	44	27.99	30.06	.00	15.6	+ 2.6	42	26	27	—22	3	4	33	14	12	86	0.04	— 0.6	1	5,823	w.	34	w.	26	13	12	6	4.5	4.5
Upper Miss. Valley.							**29.1**	**+ 1.7**								**78**			**78**	**1.19**	**— 0.7**								**4.7**	
Minneapolis	.....	102	208	.....	.....	.....	23.9	+ 3.8	45	6	31	— 1	4	17	25	.....	.....	.....		0.06	— 1.4	4	8,503	w.	34	nw.	12	11	9	11	5.2	1.9
St. Paul	837	171	179	29.12	30.06	— .02	23.9	+ 5.1	46	6	31	— 2	4	16	27	21	17	80	0.04	— 1.2	3	7,442	nw.	32	nw.	29	10	11	10	5.8	0.4
La Crosse	714	71	87	29.27	30.08	.00	26.2	+ 2.6	51	6	34	0	24	19	29	.....	.....	.....		1.17	— 0.3	5	5,820	s.	24	n.	28	9	9	13	5.7	13.0
Madison	974	70	78	28.98	30.08	.00	26.2	+ 3.5	51	7	33	— 3	24	19	25	23	21	84	1.17	— 0.6	3	7,727	w.	33	nw.	29	10	9	12	5.5	6.7
Charles City	1,015	8	58	28.97	30.10	.00	22.8	+ 1.8	51	6	33	— 7	24	13	35	20	18	88	0.61	— 0.8	4	5,618	nw.	28	nw.	9	15	8	8	4.4	6.4
Davenport	606	71	79	29.43	30.12	+ .02	29.5	+ 1.7	53	8	38	3	24	21	26	26	22	78	1.32	— 0.4	3	5,341	nw.	26	nw.	29	14	10	7	4.1	4.4
Des Moines	861	84	101	29.20	30.14	+ .03	28.9	+ 2.1	57	11	38	1	24	20	36	25	20	74	0.55	— 0.9	5	5,527	nw.	25	nw.	9	16	7	8	4.3	6.6
Dubuque	698	100	117	29.34	30.12	+ .02	27.6	+ 1.7	52	7	36	— 1	24	20	29	24	21	82	1.17	— 0.6	7	4,802	sw.	27	nw.	29	11	13	7	4.7	9.6
Keokuk	614	63	78	29.45	30.16	+ .04	32.2	+ 2.4	53	7	40	5	24	24	29	27	23	75	1.03	— 0.9	5	5,659	sw.	34	nw.	29	20	4	7	3.2	0.6
Cairo	356	87	93	29.78	30.18	+ .03	37.6	— 1.6	56	8	44	18	4	32	24	33	29	76	3.40	+ 0.1	9	7,051	sw.	34	sw.	28	8	6	17	6.5	T.
La Salle	536	56	64	29.54	30.13	+ .04	29.7	.....	52	8	38	2	24	22	26	.....	.....	.....		1.28	.....	6	6,373	w.	32	w.	29	16	5	10	5.0	2.0
Peoria	609	11	45	29.45	30.14	+ .03	29.8	.....	52	8	38	1	24	22	27	.....	.....	.....		1.60	.....	7	6,967	s.	34	w.	29	17	8	6	4.2	1.5
Springfield, Ill	644	82	93	29.42	30.13	+ .01	31.7	— 1.1	53	8	39	6	24	24	25	28	24	76	1.72	— 1.0	7	7,077	sw.	32	w.	29	17	6	8	4.0	4.0
Hannibal	534	75	109	29.55	30.15	+ .03	32.8	+ 0.9	54	7	41	10	4	24	31	.....	.....	.....		1.23	— 0.4	5	7,171	sw.	36	sw.	10	15	7	9	4.3	0.6
St. Louis	567	208	217	29.52	30.14	+ .01	35.3	— 0.3	59	11	42	13	4	28	24	31	26	71	2.06	— 0.8	6	8,577	w.	34	w.	10	16	9	6	4.0	T.
Missouri Valley.							**30.4**	**+ 1.8**								**71**			**71**	**0.33**	**— 0.7**								**3.7**	
Columbia, Mo	784	11	84	29.29	30.14	+ .02	33.4	— 1.4	55	11	42	8	4	24	32	.....	.....	.....		0.99	— 0.8	5	6,141	sw.	30	w.	28	14	12	5	3.7	2.0
Kansas City	963	78	95	29.13	30.20	+ .08	34.1	+ 2.2	60	11	42	10	4	26	27	29	23	68	0.35	— 1.2	4	5,657	sw.	24	nw.	9	17	8	6	3.3	2.0
Springfield, Mo	1,324	98	104	28.71	30.16	+ .03	34.5	— 4.1	54	11	43	12	4	26	26	29	23	66	1.72	— 0.9	6	7,004	se.	25	w.	28	16	8	7	4.0	2.7
Topeka	.....	85	89	.....	.....	.....	33.7	— 1.1	60	11	43	9	4	24	31	.....	.....	.....		0.20	— 0.7	2	5,117	s.	24	n.	9	18	8	5	3.1	1.9
Lincoln	1,189	75	84	28.82	30.14	+ .02	32.1	+ 1.7	59	11	42	1	3	22	32	26	20	66	0.96	— 0.7	1	6,777	s.	34	n.	9	19	7	5	3.2	0.8
Omaha	1,105	115	121	28.92	30.14	+ .03	31.6	+ 4.9	54	11	40	1	3	23	28	26	19	62	0.14	— 0.9	2	6,027	sw.	35	nw.	9	18	6	7	4.0	1.4
Valentine	2,598	47	54	27.32	30.14	+ .04	29.7	+ 2.5	58	11	43	— 6	3	16	41	24	19	76	0.03	— 0.3	2	6,447	nw.	34	nw.	17	18	13	0	3.1	0.3
Sioux City	1,135	96	164	28.86	30.12	.00	28.5	+ 4.4	54	17	38	— 3	3	19	36	.....	.....	.....		0.07	— 0.8	2	8,818	nw.	37	nw.	8	17	7	7	3.9	0.9
Pierre	1,572	43	50	28.40	30.14	+ .04	26.0	+ 1.3	50	25	35	—10	3	17	34	21	17	75	T.	— 0.4	0	3,706	nw.	27	nw.	17	16	10	5	3.9	T.
Huron	1,306	56	67	28.66	30.12	+ .02	22.3	+ 3.1	50	16	32	—11	3	12	36	19	16	83	0.04	— 0.6	2	7,412	nw.	34	s.	16	18	9	4	3.3	0.6
Yankton	1,233	49	57	28.76	30.12	+ .01	28.8	+ 6.3	56	10	39	— 7	3	18	41	.....	.....	.....		0.05	— 0.8	2	6,425	nw.	30	n.	9	15	5	11	4.9	0.7
Northern Slope.							**24.8**	**+ 0.2**								**74**			**74**	**0.13**	**— 0.4**								**4.5**	
Havre	2,505	11	44	27.32	30.05	.00	23.0	+ 2.4	43	15	33	—18	2	13	42	21	18	80	0.12	— 0.5	4	9,240	sw.	45	sw.	10	12	13	6	5.0	1.2
Miles City	2,371	26	48	27.50	30.16	+ .06	23.3	+ 4.0	47	11	34	— 8	3	13	30	20	17	80	0.09	— 0.2	4	3,317	s.	25	w.	26	15	11	5	4.0	1.0
Helena	4,110	8	56	25.84	30.19	+ .06	24.7	— 0.6	42	26	32	7	2	18	30	22	17	71	0.11	— 0.8	1	4,271	sw.	42	w.	27	5	14	12	6.2	1.5
Kalispell	2,962	8	34	27.00	30.18	+ .11	24.0	.....	44	19	31	4	2	17	24	23	21	87	0.49	.....	9	2,259	nw.	28	sw.	26	1	10	20	8.1	5.8
Rapid City	3,234	46	50	26.60	30.14	+ .05	31.3	+ 1.1	63	16	42	— 4	3	21	39	26	22	77	0.02	— 0.2	1	4,620	w.	24	nw.	26	19	7	5	2.7	0.2
Cheyenne	6,088	56	64	24.00	30.19	+ .10	27.6	— 0.9	58	16	40	3	30	15	41	20	8	51	0.02	— 0.3	2	7,492	nw.	40	w.	26	21	6	4	2.7	0.2
Lander	5,372	26	36	24.69	30.35	+ .20	12.3	— 8.5	43	16	26	—13	10	—1	37	8	5	84	0.55	— 0.2	3	1,530	ne.	21	sw.	16	9	18	4	4.3	5.0
Yellowstone Park	6,200	11	48	23.91	30.30	+ .14	18.8	.....	38	16	28	— 8	22	10	27	15	9	67	0.19	.....	9	5,283	s.	28	sw.	25	11	13	7	5.2	3.3
North Platte	2,821	11	51	27.14	30.18	+ .08	31.1	+ 4.0	59	11	47	2	3	16	45	22	17	71	T.	— 0.6	0	4,563	w.	27	nw.	28	20	10	1	2.3	T.
Middle Slope.							**33.3**	**— 1.6**								**63**			**63**	**0.19**	**— 0.7**								**3.8**	
Denver	5,291	129	136	24.74	30.17	+ .09	31.9	— 0.1	63	11	46	6	30	18	42	23	12	49	T.	— 0.7	0	5,470	s.	28	w.	1	15	12	4	3.5	T.
Pueblo	4,685	80	86	25.31	30.16	+ .08	28.6	— 5.1	62	6	46	— 3	29	12	52	21	11	50	0.13	— 0.4	2	3,599	nw.	29	nw.	1	17	9	5	3.6	1.9
Concordia	1,398	42	47	28.64	30.17	+ .06	33.4	+ 0.4	56	11	44	9	4	23	34	27	23	74	0.12	— 0.4	2	4,000	s.	24	s.	16	17	10	4	3.0	1.3
Dodge	2,509	44	54	27.48	30.18	+ .08	32.9	+ 0.3	58	7	47	10	10	19	41	25	21	73	T.	— 0.6	0	5,929	se.	37	se.	16	11	20	0	4.3	T.
Wichita	1,358	78	86	28.71	30.19	+ .08	35.1	— 2.8	56	11	45	15	4	26	32	29	23	68	0.21	— 0.8	2	5,366	ne.	28	n.	9	17	9	5	3.7	0.7
Oklahoma	1,214	79	86	28.84	30.17	+ .06	38.0	— 2.1	57	8	48	20	10	28	30	32	25	66	0.70	— 1.4	6	7,092	n.	30	n.	9	15	9	7	4.5	2.0
Southern Slope.							**37.6**	**— 4.3**								**73**			**73**	**1.15**	**0.0**								**4.7**	
Abilene	1,738	45	54	28.32	30.18	+ .07	41.0	— 6.5	61	20	50	21	31	32	35	36	31	75	0.85	— 0.6	6	5,213	s.	26	nw.	20	11	9	11	5.3	
Amarillo	3,676	10	49	26.30	30.14	+ .05	34.2	— 2.1	60	8	45	14	23	24	38	28	23	74	1.45	+ 0.5	4	7,738	nw.	34	n.	9	16	5	10	4.5	9.3
Roswell	3,578	9	57	26.40	30.14	+ .07	34.0	.....	58	17	47	5	24	21	41	28	23	70	1.06	.....	6	4,646	nw.	40	nw.	20	16	5	10	4.3	9.4
Southern Plateau.							**38.7**	**— 3.6**								**58**			**58**	**0.51**	**— 0.6**								**3.3**	
El Paso	3,762	10	110	26.25	30.10	+ .07	41.0	— 5.1	60	8	51	19	24	31	30	34	26	63	1.02	+ 0.5	7	7,129	nw.	56	w.	21	14	11	6	3.9	5.8
Santa Fe	7,013	33	39	23.23	30.19	+ .13	25.4	— 5.4	49	15	35	4	30	16	30	19	13	63	0.29	— 0.6	6	5,293	ne.	33	nw.	20	18	9	4	3.0	3.7
Flagstaff	6,907	12	44	23.33	30.12	+ .06	22.2	— 8.5	49	15	37	—14	30	8	47	19	15	78	0.81	— 1.1	8	4,667	ne.	30	ne.	22	14	9	8	4.2	10.7
Phoenix	1,108	50	56	28.89	30.07	+ .03	50.0	— 2.3	73	5	62	26	24	38	32	42	34	59	0.58	— 0.3	5	2,877	e.	25	w.	21	15	12	4	3.4	
Yuma	141	16	46	29.94	30.09	+ .04	54.2	— 1.7	72	7	64	35	28	44	32	43	31	46	0.34	— 0.1	5	5,142	n.	33	n.	9	27	2	2	1.4	
Independence	3,910	11	42	26.10	30.16	+ .04	39.4	+ 0.1	67	12	51	15	23	28	30	30	16	41	T.	— 2.0	0	5,928	nw.	37	n.	31	18	12	1	3.2	T.
Middle Plateau.							**25.3**	**— 5.4**								**73**			**73**	**0.44**	**— 0.5**								**4.3**	
Reno	4,532	56	63	25.60	30.30	+ .15	28.8	— 4.6	51	26	41	7	24	16	35	25	21	78	0.08	— 0.9	2	3,083	w.	40	sw.	30	15	11	5	3.9	1.2
Winnemucca	4,344	18	56	25.78	30.35	+ .17	19.5	—11.6	45	16	33	—11	22	6	37	17	14	80	0.86	— 0.4	7	4,720	ne.	20	sw.	19	14	3	14	5.0	6.6
Modena	5,479	10	43	24.67	30.20	+ .08	26.4	— 2.0	54	15	39	0	24	14	39	21	15	68	0.20	— 0.1	2	6,212	w.	38	e.	9	12	15	4	4.5	2.3
Salt Lake City	4,366	105	110	25.77	30.29	+ .14	26.2	— 6.6	44	16	34	7	30	19	22	24	19	74	0.83	— 0.8	8	2,549	se.	20	w.	1	13	6	12	5.0	10.1
Durango	6,546	18	56	23.66	30.21	+ .14	23.8	.....	49	15	38	— 2	30	10	35	17	12	70	0.43	.....	3	3,687	nw.	20	nw.	20	17	3	11	4.1	2.7
Grand Junction	4,608	43	51	25.51	30.22	+ .12	25.8	— 2.0	47	12	37	3	30	15	31	21	15	68	0.23	— 0.2	5	2,590	se.	16	e.	29	22	4	5	3.3	2.3
Northern Plateau.							**30.5**	**— 2.6**								**86**			**86**	**1.04**	**— 0.8**								**7.4**	
Baker City	3,471	52	58	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Boise	2,739	78	86	27.39	30.37	+ .17	27.6	— 5.6	44	16	34	12	23	21	23	26	23	85	0.85	— 1.1	12	2,532	w.	28	e.	30	1	13	17	7.7	5.2
Lewiston	757	10	51	29.36	30.19	+ .06	37.2	— 0.1	50	26	43	21	31	32	17	.....	.....	.....		0.86	— 0.5	9	5,762	e.	38	w.	26	2	6	23	8.3	1.2
Pocatello	4,477	46	54	25.63	30.34	+ .15	23.2	— 2.8	44	16	32	3	11	15	30	21	17	79	0.43	— 1.1	7	5,706	e.	34	sw.	1	10	16	5	4.7	4.1
Spokane	1,929	101	110	28.09	30.21	+ .13	30.6	— 0.7	41	25	35	10	31	26	24	30	28	88	1.55	— 1.0	14	3,574	ne.	36	sw.	26	1	6	24	8.5	9.5
Walla Walla	1,000	71	79	29.12	30.22	+ .10	33.9	— 3.8	54	18	39	21	14	28	23	32	30	90	1.51	— 0.1	12	3,897	s.	35	se.	30	2	8	21	7.8	0.9
N. Pac. Coast Reg.							**41.9**	**0.0**								**87**			**87**	**6.25**	**— 2.2**								**8.3**	
North Head	211	11	56	29.86	30.10	+ .07	44.8	+ 1.0	56	15	50	33	22	40	19	44	43	91	7.70	— 2.2	22	.....	e.	75	s.	25	2	5	24	8.5	
Port Crescent	259	12	29	29.76	30.04	+ .06	40.0	+ 0.6	50	5	45	28	*	35	19	.....	.....	.....		5.27	— 1.6	19	3,939	se.	30	sw.	26	0	12	19	7.8	0.3
Seattle	123	185	224	29.98	30.12	+ .11	42.6	0.0	54	10	47	32	23	38	22	41	39	88	5.62	— 0.5	19	6,755	se.	48	sw.	25	0	9	22	8.8	T.
Tacoma	213	113	120	29.89	30.12	+ .11	40.7	— 0.2	53	11	46	28	22	36	23	.....	.....	.....		5.19	— 2.2	19	4,266	sw.	34	sw.	25	1	4	26	8.9	T.
Tatoosh Island	86	7	57	29.92	30.02	+ .06	44.3	+ 1.0	52	5	47	36	31	41	10	43	41	86	8.91	— 5.6	22	15,222	s.	70	sw.	27	1	4	26	9.2	
Portland, Oreg	153	68	96	29.98	30.15	+ .08	40.6	— 0.7	54	7	45	27	11	36	19	38	36	84	6.41	— 1.4	19	4,567	se.	30	sw.	24	0	6	25	8.7	T.
Roseburg	510	9	57	29.62	30.19	+ .08	40.4	— 1.6	61	5	47	24	11	34	26	38	36	86	4.64	— 1.8	18	1,879	s.	30	w.	30	7	10	14	6.5	
Mid. Pac. Coast Reg.							**46.7**	**— 1.7**								**71**			**71**	**2.24**	**— 3.2**								**5.3**	
Eureka	62	62	80	30.13	30.20	+ .08	46.6	— 2.0	63	10	53	32	24	40	22	44	41	80	4.32	— 3.0	16	4,106	se.	48	n.	28	7	12	12	6.0	
Mount Tamalpais	2,375	11	18	27.68	30.19	+ .07	45.4	.....	62	12	50	31	31	41	15	39	30	63	2.47	.....	10	14,817	nw.	69	nw.	30	12	6	13	5.5	T.
Red Bluff	332	50	56	29.86	30.23	+ .09	45.2	— 1.5	70	11	54	25	24	36	30	40	34	69	2.02	— 3.3	6	3,485	n.	36	s.	30	13	4	14	5.4	T.
Sacramento	69	106	117	30.13	30.20	+ .06	44.4	— 2.7	68	10	54	28	24	35	32	41	37	77	0.56	— 3.6	7	5,193	se.	36	se.	28	14	8	9	4.6	
San Francisco	155	161	167	30.05	30.22	+ .10	50.7	— 0.7	67	9	56	39	31	45	17	45	39	68	2.05	— 3.0	8	4,444	n.	35	nw.	30	14	7	10	4.8	
S. Pac. Coast Reg.							**52.2**	**— 0.6**								**61**			**61**	**0.33**	**— 2.7**								**3.4**	
Fresno	330	67	70	29.84	30.21	+ .08	43.0	— 3.3	68	14	52	26	24	34	34	40	37	81	0.41	— 1.1	6	2,692	s.	24	nw.	20	3	12	16	7.3	
Los Angeles	338	116	123	29.71	30.08	+ .01	57.0	+ 1.6	79	13	68	33	23	46	33	46	34	48	0.20	— 3.8	3	4,261	ne.	23	n.	29	23	3	5	2.1	
San Diego	87	94	102	29.97	30.06	— .01	56.0	+ 0.2	74	14	64	38	24	48	22	47	39	58	0.38	— 1.8	5	4,126	ne.	27	w.	20	28	0	3	1.4	
San Luis Obispo	201	47	54	29.94	30.16	+ .05	52.7	— 0.7	76	9	64	26	24	41	37	45	36	57	0.32	— 4.2	6	4,260	n.	22	n.	24	22	6	3	3.0	
West Indies.																															
Grand Turk	11	6	20	30.02	30.03	+ .02	78.8	.....	86	18	84	70	*	74	.....	.....	.....	.....	1.54	.....	15	.....	se.	28	e.	3	.....	.....	.....	.....	.....
San Juan	82	48	90	29.92	30.00	+ .03	77.9	— 0.7	86	10	82	68	26	72	14	71	69	79	2.85	— 1.4	19	8,004	e.	32	e.	14	15	16	0	3.9	

*More than one date.

TABLE II.—*Climatological record of cooperative observers, December, 1905.*

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Alabama.	°	°	°	*Ins.*	*Ins.*
Alaga				8.66	
Anniston	69	19	42.0	7.74	
Ashville	67	21	42.0	6.56	
Benton				4.48	
Bermuda	68	23	45.4	6.85	
Boligee	71	20	43.2	5.10	
Bridgeport				7.08	
Burkeville				4.93	
Calera				8.30	
Camp Hill	68[5]	24[5]	42.6[5]	10.50	
Cedar Bluff				8.64	
Citronelle	71	25	48.7	7.22	
Clanton	68	21	43.2	7.38	
Cordova	65	17	44.6	3.96	
Dadeville				6.33	
Daphne	75	26	50.0	6.55	
Decatur	71	29	43.4	5.10	2.5
Demopolis				6.30	
Eufaula	65	25	44.1	8.29	
Evergreen	69			4.45	
Flomaton	66	24	48.4	5.70	
Florence	68	18	41.4	4.93	2.0
Fort Deposit	68	23	43.6	5.29	
Gadsden	70	22	43.4	6.96	
Goodwater	72	23	43.0	7.18	
Greensboro	70	24	44.6	7.56	
Greenville				4.50	
Guntersville				6.02	
Hamilton	67	17	41.8	5.70	4.5
Highland	64	22	44.6	5.88	
Letohatchie				3.86	
Livingston	70	22	41.6	6.44	
Lock No. 4	69	20	42.8	7.32	
Lucy	73	21	48.4	8.67	
Madison Station	67	16	42.5	4.39	2.0
Maplegrove	69	23	41.1	7.88	
Marion	67	23	42.3	7.48	
Milstead				8.34	
Newbern	71	21	43.5	6.84	
Notasulga				6.54	
Oneonta	67	17	41.3	6.12	T.
Opelika	66	24	43.7	11.72	
Ozark	68	31	49.0	4.59	
Prattville	69	20	44.6	5.56	
Pushmataha	74	21	45.1	7.56	
Riverton	67	14	39.6	5.52	0.8
Scottsboro	68	18	42.5	7.96	T.
Selma	65	25	43.9	5.24	
Springhill	70	30	50.5	7.11	
Talladega	65	20	42.7	6.27	
Tallassee				7.90	
Thomasville	68	23	45.8	2.96	
Tuscaloosa	69[5]	21[5]	42.4[5]	4.79	
Tuscumbia	66	29	40.1	5.28	T
Tuskegee	69	25	46.6	11.38	
Union Springs	66	24	44.8	10.13	
Uniontown	71	21	44.9	6.06	
Valleyhead	59	15	40.0	7.07	
Vienna				4.48	
Wetumpka	75	23	46.8	6.31	
Alaska.					
Killisnoo	46	19	36.1	7.75	12.5
Loring	44	15	34.4	25.92	15.5
Orca	49	15	31.4	12.81	57.0
Sitka	49	23	38.0	11.21	6.0
Skagway	42	9	29.7	2.21	18.0
Arizona.					
Allaire Ranch				0.61	2.4
Alpine				2.55	25.5
Arizona Canal Co. Dam	75	25	50.6	0.77	
Aztec	73	27	49.3	0.20	
Benson	69	10	43.9	0.79	T.
Blue	53	1	31.1	1.38	15.2
Bowie	69	21	41.3	0.78	5.0
Buckeye	71	23	48.0	0.45	
Casagrande	72	25	48.4	0.80	
Cochise[1]	68	18	44.7	0.82	4.0
Congress	67	30	47.5	1.10	6.0
Douglas	67	18	43.0	0.70	2.9
Dudleyville	72	23	45.9	1.60	3.5
Duncan	65	11	36.2	1.25	9.0
Flagstaff				1.07	23.2
Fort Apache	64	−12	31.8	1.75	10.5
Fort Defiance	46	−20	21.1	1.21	12.1
Fort Huachuca	58	20	40.7	1.34	9.2
Gilabend	75	28	50.5	0.30	
Globe	63	20	41.2	1.47	1.5
Grand Canyon	45	−14	19.8	1.71	14.8
Greer				2.07	20.0
Holbrook	55	−12	25.9	1.11	11.5
Huachuca Res				3.45	10.6
Jerome	59	19	39.4	1.03	9.8
Kingman	64	20	41.8	0.81	3.0
Maricopa	75	22	49.0	0.85	
Mesa	76	25	49.8	0.76	
Mohawk Summit[1]	70	35	48.6	0.34	
Natural Bridge				1.47	9.0
Nutrioso				4.11	43.0
Oracle	59	22	41.1	1.66	4.6
Parker	77	21	49.8	0.40	
Phoenix	73	22	48.0	0.48	
Picacho[1]	72	31	49.1	0.70	
Pinal Ranch				2.44	9.0
Pinto				1.00	8.0
Prescott	62	1	34.5	1.53	16.0
Roosevelt	76	23	45.6	1.78	0.5
San Carlos	68	20	43.6	0.98	T.
San Simon	60	14	39.0	1.43	3.9
Seligman	61	−6	31.9	1.48	16.0
Sentinel[1]	73	33	49.4	0.18	
Signal	68	23	46.6	0.59	2.5
Taylor				1.36	12.0
Tempe	72	21	47.3	0.63	
Thatcher	64	17	41.0	0.75	1.0
Tombstone	60	19	40.4	1.00	5.5
Tonto	67	22	44.5	1.02	T.
Tuba	57	3	29.6	0.90	8.4
Tucson	72	11	47.2	0.90	
Vail[3]	77	30	51.5	1.13	8.0
Walnut Grove				1.15	9.5
Willcox	60	17	39.9	1.06	8.0
Yarnell				1.07	5.5
Young	75	2	41.0	1.58	11.1
Yuma (Date orchard)	72	20	48.3	0.23	
Arkansas.					
Amity	64	18	38.8	6.20	1.0
Arkadelphia	64	20	39.8[5]	7.46	T.
Arkansas City				5.94	
Arnett	55[5]	15[5]	34.7[5]	1.78	T.
Batesville	58	18	38.5	5.18	4.0
Blackrock				4.40	0.3
Brinkley	60	22	39.9	6.63	T.
Calico Rock				3.38	
Camden	69	22	40.5	7.00	5.0
Clarendon				7.31	0.6
Conway	59	19	39.2	5.42	4.0
Corning	61	18	37.8	4.60	3.0
Dallas	56	21	38.8	4.67	1.0
Dardanelle				5.20	
Des Arc	60	20	39.7	6.54	4.8
Dodd City	54	11	34.6	3.52	0.2
Dutton	59	13	35.8	3.03	1.4
Eldorado	65	22	39.5	6.21	2.5
Eureka Springs	56	10	35.4	2.65	T.
Fayetteville	59	15	35.4	2.09	
Forrest City	60	20	40.7	6.59	
Fulton				6.72	4.4
Hardy	61	18	37.7	4.68	4.0
Helena	62	22	41.2	5.14	
Hope	60	23	41.1	6.32	2.2
Howe	69	22	41.2	7.80	2.0
Jonesboro	63[3]	20	39.2[5]	5.18	0.2
Lacrosse	59	16	38.2	4.19	5.5
Lake Village	64	22	41.7	6.88	
Lonoke	59	20	38.7	5.97	1.1
Lutherville	60	16	37.4	4.22	1.0
Luxora				3.20	
Malvern	63	20	38.2	6.20	0.5
Marked Tree				4.81	2.0
Marvell	61	20	41.0	5.14	0.3
Mossville	56	14	34.4	3.66	T.
Mountain Home	59	14	34.0		
Mount Nebo	51	21	36.7	3.30	1.0
New Lewisville	62	23	40.5	6.98	2.0
Newport				5.48	4.0
Oregon	64	7	35.6	2.78	0.1
Osceola	60	20	40.4	4.41	0.5
Ozark	62	11	38.6	3.51	0.5
Perry	56	22	38.5	4.26	1.2
Pinebluff	66	21	38.8	6.87	2.5
Pocahontas	60	15	37.4	4.45	7.8
Prescott	60	23	40.6	6.87	3.0
Princeton	64	18	39.0	5.81	
Rison	61	18[5]	39.1	6.21	T.
Russellville	56	19	35.2	3.53	1.2
Silversprings	65	12	36.6	1.70	0.2
Spielerville	58	22	39.1	3.99	2.5
Stuttgart	68	20	40.2	7.34	2.2
Tate	59	16	38.4	4.90	T.
Texarkana	56	22	38.5	6.87	0.2
Warren	62	18	39.2	6.67	2.4
White Cliffs				5.14	1.5
Wiggs	59	17	37.9	5.81	2.6
Witts Springs	49	11	32.9	2.07	0.5
California.					
Alturas				0.52	9.0
Angiola	71	17	40.4	0.18	
Auburn	63	30	46.0	1.87	
Azusa	81	26	54.1	0.35	
Bagdad	68	33	51.4	0.10	
Bakersfield	76	13	45.8	0.32	
Barber				2.22	
Barstow	75	18	48.0	T.	
Bear Valley				3.64	25.5
Berkeley	67	31	47.4	2.22	
Bishop	72	8	37.1	0.05	0.5
Blue Canyon	70	10	38.0	5.30	23.0
Bodie	69	−21	22.0	1.45	17.0
Bowman				3.69	30.0
Branscomb	73	23	44.0	8.72	0.5
Brush Creek	60	20	38.8	4.60	7.0
Butte Valley				3.13	27.0
Calexico	70	29	52.2	0.54	
Campbell	66	26	45.6	1.36	
Campo				1.12	T.
Cedarville	46	− 5	24.8	0.70	15.0
Chico	69	25	43.7	2.39	
Claremont	79	27	52.8	0.48	
Cloverdale	75	28	47.0	2.89	
Colusa	68	24	44.8	0.42	
Craftonville				0.32	2.0
Crescent City	59	29	45.8	9.04	
Crockers				2.38	11.0
Cuyamaca	49	12	33.6	2.78	
Delta	68	27	44.6	2.79	4.0
Dimond				2.09	
Dobbins	80	30	49.6	2.34	
Drytown	65	26	43.2	1.83	
Durham	71	22	44.8	2.02	
Elcajon	80	23	52.8	0.55	
Electra	67	29	47.2	2.17	
Elmwood	63	22	42.2	0.59	
Elsinore	76	20	50.3	0.20	
Emigrant Gap	68	29	36.7	4.80	35.0
Escondido	90	26	61.5	0.83	T.
Folsom	69	30	45.1	1.28	
Fordyce				3.13	32.0
Fort Ross	59	32	46.9	3.85	
Fruitvale				2.26	
Georgetown	70	23	44.4	3.49	5.0
Gilroy (near)	70	23	46.0	1.35	
Glendora				0.28	
Grass Valley				3.54	12.0
Greenville	53	0	27.6	1.62	16.0
Hanford	71	21	43.3	0.23	
Healdsburg	79	24	47.8	2.39	
Hollister	68	24	45.7	1.09	
Indio	79	20	53.6	0.14	
Idylwild	66	11	38.8	1.93	T.
Imperial	81	22	52.8	0.30	
Iowa Hill	73	23	45.9	3.06	6.0
Irvine				0.30	
Isabella				0.30	
Jolon				0.33	
Kennedy Gold Mine				1.84	
Kentfield				3.95	
Kernville				0.29	
King City	82	18	51.2	0.35	
Laporte	60	11	35.5	4.55	41.0
Le Grand	66	25	42.5	0.87	
Lemoncove	70	25	45.0	1.53	
Lick Observatory	64	23	41.6	2.04	4.2
Livermore	71	26	46.8	1.18	
Lodi	61	23	42.4	0.70	
Lone Pine	69	10	37.8	0.00	
Los Gatos	65	30	47.8	1.64	
Lowe Observatory				0.12	T.
Magalia	68	24	45.1	3.32	7.0
Mammoth	73[6]	25[6]	50.2[6]	0.00	
Marysville	70	23	43.6	1.07	
Merced	67	22	43.6	0.38	
Mercury				3.61	
Mills College				2.12	
Milo				1.51	
Milton (near)	61	30	45.2	0.83	
Mohave	70	20	46.0	0.00	
Mokelumne Hill	67	28	47.2	1.93	
Montague	57	8	32.4	1.26	8.0
Monterio	72	22	46.1	4.02	
Monumental	55	20	36.6	11.86	21.0
Mount St. Helena				3.83	
Napa	68	27	43.0	1.17	
Needles	70	28	51.4	0.00	
Nellie				2.68	4.0
Nevada City	80	15	42.6	2.57	6.0
Newcastle	68	30	46.5	1.70	
Newman	61	25	43.0	0.98	
Niles	66	32	47.6	2.16	
Nordhoff	65	16	42.7	T.	
North Bloomfield	79	15	41.6	3.58	6.0
Oakland	66	34	48.3	1.90	
Orland	69	24	46.0	1.26	
Orleans	64	26	45.2	5.64	2.0
Oroville (near)	72	26	45.2	1.59	
Ozena				0.52	
Palermo	75	23	45.1	1.27	
Peachland	77	23	45.8	2.93	
Pilot Creek				4.91	15.0
Pine Crest	77	37	56.7	0.06	
Placerville	66	20	41.1	2.73	
Point Lobos	64	45	55.8	1.88	
Point Reyes Light	65	41	51.4	2.38	
Porterville	72	25	44.5	0.70	
Poway	77	21	52.6	0.84	

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
California—Cont'd.	°	°	°	*Ins.*	*Ins.*
Priest Valley				0.43	
Quincy	48	3	27.4	2.23	12.5
Redding	72	24	45.4	1.88	1.0
Redlands	79	28	52.6	1.29	
Reedley	71	24	43.8	0.46	
Represa				1.29	
Riovista	67	25	43.8	0.57	
Riverside	77	26	50.8	0.48	
Rocklin	64	25	44.1	1.62	
Rohnerville				4.26	
Sacramento	65	26	43.6	0.75	
Salinas	68	29	49.2	0.91	
Salton	78	25	51.3	0.00	
San Bernardino	82	24	52.0	0.74	
San Jacinto	75	22	48.9	0.22	
San Jose	69	27	47.4	1.23	
San Leandro	68	26	44.8	2.26	
San Miguel Island				0.14	
Santa Barbara	80	35	55.8	0.07	
Santa Clara College	71	25	46.8	1.44	
Santa Cruz	72	24	48.6	2.09	
Santa Maria	78	28	51.4	0.31	
Santa Monica				T.	
Santa Rosa	75	22	45.2	1.81	
Sausalito				2.78	
Shasta	80	27	47.7	3.28	5.4
Sierra Madre	76	36	54.8	0.45	
Sisson	55	10	32.1	3.16	22.0
Sonoma	72	23	46.4	1.80	
Sonora	56	28	41.6	1.95	0.5
Southeast Farallon	62	45	53.0	2.15	
Sterling				4.57	17.0
Stockton	58	25	42.5	0.51	
Storey	68	24	42.0	0.33	
Summerdale	68	13	39.9	2.16	15.0
Susanville	45	— 1	23.0	0.82	15.0
Tejon	70	26	45.0	2.28	T.
Truckee	48	— 2	22.3	2.90	29.0
Tulare	78	22	44.4	0.52	
Tustin				0.22	
Ukiah	69	21	43.3	3.41	
Upland	69	28	49.3	0.90	
Upperlake	74	22	44.6	2.12	
Upper Mattole				8.20	
Vacaville	74	22	46.2	0.75	
Ventura	80	34	54.4	0.02	
Visalia	76[b]	21	43.8[d]	0.45	
Volcano	69	24	50.2	T.	
Wasco	70	21	42.0	0.30	
Weldon				0.32	
Westpoint				2.78	4.0
West Saticoy				T.	
Wheatland	69	24	43.0	1.35	
Willits	75	20	45.0	5.68	
Woodside	62	29	45.6	2.92	
Yreka				2.04	11.0
Zenia	70	21	42.7	6.55	8.0
Colorado.					
Akron				0.00	
Alford	61	— 3	26.8	0.00	
Antelope Springs	40	—33	0.3	0.04	0.4
Ashcroft	47	—18	14.0	0.34	6.5
Bennett				0.00	
Boulder	63	13	36.2	T.	T.
Breckenridge	46	—21	13.4	0.34	5.5
Buenavista	39	— 5	14.3	0.00	
Burlington	65	5	30.1	T.	
Canon City	62	12	37.4	T.	T.
Cardinal	41	— 7	18.6	0.45	5.0
Castlerock	65	—10	25.8	0.05	1.0
Cheesman	62	— 7	26.9	0.10	1.8
Cheyenne Wells	59	5	30.2	T.	T.
Clearview	52	—13	19.2	0.17	3.5
Collbran	42	—13	16.3	0.80	12.8
Colorado Springs	60	3	29.3	T.	T.
Cripplecreek				0.04	0.6
Delta	46	— 6	22.4	0.10	2.0
Eagle	34	—17	10.6	0.19	2.5
Fort Collins	62	— 4	27.1	T.	T.
Fort Morgan	58	— 3	28.0	0.00	
Fowler				0.05	0.5
Frances	56	— 1	23.8	0.27	3.5
Fruita	45	— 6	22.8	0.29	3.0
Garnett	44	—15	14.8	0.00	
Gleneyre	62	— 5	27.3	T.	T.
Glenwood Springs	45	—17	16.8	0.32	5.5
Grand Valley	46	—13	20.6	1.28	13.0
Greeley	63	— 4	27.6	0.00	
Gunnison	37	—46	4.0	0.19	3.0
Hahns Peak	46	—28	12.0	1.31	21.5
Hamps	65	— 1	27.3	T.	T.
Hoehne	65	—13	25.8	0.10	1.0
Holly	65	5	33.2	T.	T.
Holyoke	61	— 1	30.2	T.	T.
Idaho Springs	60	0	28.0	0.10	1.5
Lake City	40	—24	11.8	0.39	7.0
Lamar	65	4	33.8	T.	
Laporte				0.00	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Colorado—Cont'd.	°	°	°	*Ins.*	*Ins.*
Las Animas	60	1	29.3	0.00	
Lay	43	—25	11.9	0.60	9.5
Leroy	60	7	30.8	0.02	0.2
Longs Peak	58	—13	19.8	0.00	
Mancos	51	— 9	24.2	0.58	10.0
Meeker	48	—19	14.5	0.56	6.2
Montrose	49	—14	21.6	0.22	3.0
Moraine	56	— 9	23.0	0.00	
Pagoda	49	—15	17.6	0.80	13.0
Paonia	48	— 1	24.0	0.49	7.0
Platte Canon				0.06	1.8
Rockyford	60	— 4	27.9	0.05	1.0
Saguache	43	— 7	17.0	T.	T.
Salida	55	—14	21.8	0.15	3.0
San Louis		—14		T.	T.
Santa Clara	58	— 8	25.0	0.85	16.0
Sapinero	29	—20	8.2	1.02	14.6
Sheridan Lake	58	0	28.8	T.	0.1
Silt	46	— 4	21.4	0.69	9.8
Silverton	46	—26	12.2	0.35	5.5
Sugar City				0.04	0.5
Trinidad	68	— 1	30.8	0.10	3.0
Victor	51	— 2	24.2	0.09	0.8
Vilas				0.00	
Wagon Wheel	32	—33	0.2	0.05	1.0
Waterdale	61	0	29.2	0.00	
Westcliffe	55	—15	20.2	0.03	0.5
Whitepine	40	—22	9.7	0.25	5.0
Wray	65	1	30.1	T.	T.
Yuma				0.00	
Connecticut.					
Bridgeport	57	14	35.4	5.00	2.0
Canton	57	4	31.2	3.38	3.0
Colchester	58	7	33.2	5.50	8.0
Falls Village				3.02	4.8
Hawleyville	56	10	33.2	3.62	4.0
New London	59	11	35.8	5.00	1.5
North Grosvenor Dale	57	4	30.6	4.28	
Norwalk	56	11	32.5	4.37	2.0
Southington	57	7	32.7	4.50	4.0
South Manchester				3.55	11.0
Storrs	58	5	32.6	4.12	
Voluntown	60	8	34.3	5.05	4.0
Wallingford	55	7	29.7	5.03	6.0
Waterbury	56	9	33.4	3.72	4.0
West Cornwall	53	5	29.6	2.59	6.0
West Simsbury				3.12	4.0
Delaware.					
Delaware City				3.64	1.5
Milford	62	18	39.0	4.94	1.5
Millsboro	64	18	39.1	6.21	2.0
Newark	57	15	36.7	4.14	3.0
Seaford	62	17	38.3	4.58	3.0
District of Columbia.					
Distributing Reservoir*[5]	57	18	37.6	5.08	
Receiving Reservoir*[5]	54	15	36.2	5.13	
West Washington	60	16	36.7	5.96	5.0
Florida.					
Apalachicola	68	32	53.8	9.18	
Archer	80	27	54.8	5.46	
Avon Park	90	44	63.5	10.28	
Bartow	82	39	62.8	8.25	
Bonifay	73	27	49.4	9.17	
Brooksville	82	36[h]	59.4[d]	5.60	
Carrabelle	75	32	55.8	9.56	
Caxambus	90	49	69.4	4.46	
Clermont	84	42	61.9	6.64	
De Funiak	74	25	48.7	8.79	
Deland	83	39	60.2		
Eustis	83	35	59.3	5.65	
Federal Point	80	35	57.1	3.59	
Fernandino	78	35	53.8	9.00	
Flamingo	84	52	70.8	10.10	
Fort Meade	83	39	61.2	8.74	
Fort Myers	82	45	64.6	6.21	
Gainesville	79	32	55.8	5.63	
Grasmere	79	40	59.7		
Huntington	81	34	56.4	4.61	
Hypoluxo	84	49	68.5	7.00	
Inverness	83	35	57.4	5.39	
Jasper	77	28	50.4	8.27	
Kissimmee	77	39	59.4	9.43	
Lake City	77	29	53.7	6.56	
Macclenny	76	27	53.8	6.28	
Madison	72	23	50.4	9.26	
Malabar	84	43	63.8	6.05	
Manatee	81	42	62.4	7.21	
Marianna	70	27	49.6	11.20	
Merritt Island	81	47	63.2	9.18	
Miami	85	50	69.6	12.08	
Middleburg	81	23	54.2	4.90	
Molino	75	21	49.2	7.10	
Monticello	70[d]	29[d]	50.2[d]	12.13	
Mount Pleasant	74	26	49.8	7.50	
New Smyrna	83	39	64.4	7.41	
Nocatee	85	41	63.8	6.85	
Ocala	84	32	57.6	7.08	
Orange City	85	34	59.5	5.65	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Florida—Cont'd.	°	°	°	*Ins.*	*Ins.*
Orange Home	83	35	59.8	5.73	
Orlando	81	38	60.4	8.43	
Plant City	82	36	60.8	7.62	
St. Andrews	70	26	50.5	8.38	
St. Augustine	81	35	57.6	3.33	
St. Leo	83	38	60.1	5.13	
Sand Key	80	61	71.2	6.54	
Stephensville	80	27	53.6	8.86	
Sumner	85	26	55.6	6.93	
Switzerland	80	33	55.2	5.00	
Tallahassee	72[e]	30[e]	50.7[e]	9.75	
Tarpon Springs	83	35	59.7	4.34	
Titusville	85	39	61.0	8.63	
Wausau	75	27	50.3	9.16	
Georgia.					
Abbeville				7.86	
Adairsville	64[e]	20[e]	40.6[e]	9.53	
Allapaha	72	27	47.3	8.81	
Americus	67	25	44.5	6.98	
Athens	60	21	39.7	10.24	0.2
Bainbridge	75	25	48.8	7.89	
Blakely	74	26	47.4	8.51	
Bowersville	64	20	42.6	8.05	
Butler				7.32	
Camak	68	22	41.0	10.87	
Canton				10.36	
Carlton				9.44	
Carrollton	65	21	41.0	3.40	
Clayton	64	20	41.4	10.35	0.2
Columbus	76[g]	28[g]	47.1[g]	9.66	
Cordele	73	23	45.7	8.70	
Covington				8.54	
Cuthbert	64	26	46.8	5.34	
Dahlonega	63	15	40.8	10.55	T.
Dawson	73	27	47.3	8.63	
Diamond	65	13	42.3		4.0
Dublin				8.62	
Dudley	74	25	45.8	8.49	
Eastman	71	25	46.0	8.52	
Eatonton	[illegible]	21	44.0	7.68	
Elberton	64	22	42.2	9.49	T.
Experiment	[illegible]7	22	42.6	8.13	
Fitzgerald	70	27	47.8	7.66	
Fleming	81	26	49.4	7.73	
Forsyth	67	22	44.1	7.79	
Fort Gaines	67	25	45.6	8.30	
Gainesville	60	22	40.3	8.88	
Gillsville	64	20	42.8	9.47	
Glenville	72	28	47.0	7.51	
Greenbush	58	18	40.5	9.12	T.
Greensboro	68	21	42.0	7.69	0.1
Griffin	66	22	44.3	7.43	
Harrison	72	19	44.4	7.86	
Hawkinsville	73	24	45.8	7.70	
Lost Mountain	63	15	41.8	8.45	
Louisville	74	25	46.2	8.03	
Lumpkin	71	24	44.2	8.24	
Marshallville	67	26	45.8	9.54	
Mauzy	75	26	49.8	9.05	
Milledgeville	66	22	43.8	7.91	
Millen	78	24	45.6	5.85	
Montezuma				8.80	
Monticello	68	21	43.2	9.24	
Morgan	70	27	46.0	9.05	
Newnan	64	19	40.4	8.69	
Oakdale				9.21	
Oxford		21[f]	41.4[g]	9.32	
Point Peter	67	18	42.2	10.56	T.
Poulan	73	25	46.9	9.22	
Putnam	68	24	45.0	7.57	
Quitman	71	29	49.2	11.60	
Ramsey	62	15	42.0	9.01	T.
Resaca				9.95	
Rome	67	20	40.4	9.70	
St. George	78	30	53.3	7.39	
St. Marys	79	31	51.9	6.62	
Screven	76	28	52.8	7.69	
Statesboro	77	26	47.4	6.28	
Talbotton	69	24	44.5	7.04	
Tallapoosa	58	17	37.8	5.67	
Thomasville	74	28	48.6	8.83	
Toccoa	64	19	40.4	10.23	T.
Valdosta	71	32	52.4	10.40	
Valona	75	30	49.7	7.85	
Vidalia	72	26	49.8	6.33	
Washington	63	22	41.1	8.92	T.
Waverly	77[f]	28[f]	52.8[f]	8.26	
Waycross	75	30	49.2	7.55	
Waynesboro	79	25	47.2	8.18	
Westpoint	67	22	43.0	10.71	
Woodbury	67	19	42.0	7.75	
Idaho.					
American Falls	47	— 2	21.1	0.55	
Blackfoot	40	— 8	18.7	1.10	11.0
Caldwell	47	5	27.0	0.81	10.4
Cambridge	43	—11	21.3	1.90	
Chesterfield	45	—22	14.2	0.49	13.0
Dent	40[e]	24[d]	32.8[e]	2.65	16.5

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Idaho—Cont'd.	°	°	°	*Ins.*	*Ins.*
Ellerslie	49	5	25.8	0.86	10.4
Fernwood				2.88	24.5
Forney	44	−11	19.4	0.77	7.8
Garnet	54	9	31.8	0.11	.....
Glens Ferry	48	2	27.9	0.80	8.0
Grangeville	44	6	30.6	0.63	4.5
Hope				3.95	24.0
Idaho Falls	39	−11	16.6	0.56	11.5
Kellogg	40	10	28.2	1.78	15.0
Lake	40	−12	13.0	2.10	21.0
Lakeview	41	16	30.8	3.00	26.0
Landore	44	5	23.3	3.14	46.8
Lardo				3.61	.....
Lost River	42	− 6	16.6	0.10	1.0
Meadows	39	−11	19.3	1.85	30.8
Milner	44	− 3	21.8	0.91	9.5
Minidoka	45	− 3	22.6	0.71	8.0
Moscow	44	17	33.4	2.04	9.9
Murray	39	2	24.1	2.71	38.0
Oakley	60	− 1	26.6	0.50	5.0
Ola	48	−10	20.7	1.98	14.9
Paris	43	−10	17.2	0.31	4.5
Payette	48	2	26.3	0.75	5.7
Pearl				1.11	.....
Pollock	50	17	36.1	.....	.....
Poplar				0.93	.....
Porthill	43	12	29.5	1.56	13.0
Roosevelt	47	− 1	22.3	1.69	16.0
St. Maries	43	14	31.8	1.85	13.0
Salem				0.69	6.9
Soldier	48	−20	13.2	1.45	14.5
Stanrod				0.30	4.8
Westlake				0.88	.....
Weston	45	− 9	19.4	0.30	3.5
Illinois.					
Albion	52	11	34.0	3.56	T.
Aledo	54	− 1	29.0	1.29	4.1
Alexander	55	3	31.4	1.42	2.3
Antioch	50	6	27.4	1.55	7.0
Ashton	51	1	27.4	1.17	5.1
Astoria	51	3	30.4	1.71	2.2
Aurora	50	− 1	28.6	1.35	1.6
Beardstown				1.62	.....
Bloomington	56	4	31.5	1.89	4.7
Bushnell	60	6	30.8	1.31	.....
Cambridge	53	0	29.4	1.25	8.0
Carlinville	56	6	32.6	2.18	2.0
Carrollton	57	8	32.8	1.85	1.0
Charleston	50	5	32.6	2.36	1.3
Chester	54	19	36.9	2.78	
Cisne	58[c]	11[c]	35.0[c]	3.40	0.9
Coatsburg	50[g]	1[g]	30.9[g]	1.29	0.5
Cobden	56	15	36.5	3.50	T.
Colchester	54	1	31.5	1.10	T.
Decatur	55	2	31.2	1.90	2.5
Dixon	52	1	26.4	1.12	4.5
Dwight	51	0	30.0	1.64	2.8
Equality	56	17	37.2	3.30	T.
Flora	53	6	33.2	2.86	1.4
Friendgrove	52	13	35.0	3.63	T.
Galva	52	− 1	27.0	1.56	2.5
Grafton				2.19	T.
Greenville	58	9	33.6	2.08	0.7
Griggsville	58	7	34.4	1.69	.....
Halfway	55	15	35.8	3.19	T.
Havana	52	3	30.6	1.72	0.5
Henry	54	− 1	30.1	1.63	1.5
Hillsboro	56	8	33.7	2.15	0.3
Hoopeston	50	2	30.7	1.47	5.4
Joliet	48	5	29.4	1.46	4.9
Kishwaukee	53	− 2	27.2	1.45	3.0
Knoxville	53	− 1	29.7	1.78	2.2
Lagrange	51[c]	2[c]	30.6[c]	0.46	0.5
Laharpe	58	1	30.2	1.14	1.0
Lanark	51	− 1	26.2	0.96	4.9
Loami				1.63	1.7
McLeansboro	54	18	36.4	3.46	T.
Martinsville	57	6	33.6	1.75	1.0
Martinton	53	− 3	30.4	1.60	3.0
Mascoutah	58	13	35.1	2.23	2.5
Mattoon	56	9	37.4	1.73	0.9
Minonk	52	− 1	29.6	1.42	3.0
Monmouth	51	2	29.0	1.40	2.5
Morrison	53	0	28.0	1.48	3.7
Morrisonville	51	9	31.8	2.31	1.2
Mount Carmel				3.32	T.
Mount Pulaski	52	4	30.5	1.74	1.7
Mount Vernon	60	12	35.4	3.89	.....
New Burnside	56	14	35.8	3.58	T.
Olney	53	10	34.4	2.41	2.1
Ottawa	52	4	29.8	1.70	1.1
Palestine	54	10	34.0	2.61	T.
Pana	54	2	32.0	2.27	T.
Paris	52	9	33.4	2.42	.....
Peoria	52	3	31.7	1.61	1.5
Philo	49	8	30.6	1.87	.....
Plumhill	60	8	33.4	2.65	2.5
Pontiac	58	3	30.6	1.71	3.0
Rantoul	53	1	30.2	1.58	2.5
Raum	57	13	35.5	4.53	T.
Riley	51	− 2	27.4	1.40	6.1
Robinson	54	9	34.1	2.88	0.8
Rockford	54	7	31.8	0.93	3.0
Rushville	56	1	31.8	1.72	T.
St. Charles	52	− 1	28.0	1.74	5.0
St. John	59	15	35.8	2.81	T.
Shobonier	58[l]	12[l]	32.8[l]	.....	1.5
Streator	52	0	28.8	1.41	.....
Sullivan	51	5	31.4	2.12	2.8
Sycamore	51	1	26.6	1.66	1.0
Tilden	60	11	35.1	2.92	1.5
Tiskilwa	59	− 2	28.4	1.60	3.2
Tuscola	52	7	31.0	1.85	0.4
Urbana	52	3	29.8	1.31	1.0
Walnut	52	3	29.6	1.42	0.6
Warsaw				0.70	T.
Winchester	55	8	32.1	1.36	0.6
Windsor	54	6	32.2	2.14	1.3
Winnebago	52	− 1	27.0	1.48	6.0
Yorkville	48	0	28.2	1.41	0.6
Zion	49	− 2	25.0	0.44	4.0
Indiana.					
Anderson	51	11	32.4	1.85	0.5
Angola	47	10	29.9	1.69	5.7
Auburn	49	10	28.9	1.74	.....
Bedford	53	11	35.1	3.40	T.
Bluffton	55	10	30.8	2.12	1.2
Butlerville	54	12	34.5	2.63	1.0
Cambridge City	53	9	31.1	2.16	0.5
Columbia	57	11	35.0	2.70	0.2
Connersville	54	12	35.0	2.22	T.
Delphi	50	5	29.8	1.72	3.0
Elkhart	49	10	30.2	1.49	1.7
Farmersburg	54	7	33.8	2.11	
Farmland	50	12	32.0	2.12	1.7
Fort Wayne	50	12	31.8	2.10	2.3
Franklin	56	11	33.6	1.95	T.
Greencastle	52	7	32.8	2.37	0.9
Greenfield	54	10	33.4	1.49	1.0
Greensburg	55	11	34.4	2.39	3.0
Hammond	51	0	30.6	1.34	6.0
Holland	56	14	36.4	.....	.....
Huntington	49	11	30.6	2.21	11.0
Jeffersonville	55	19	36.8	5.58	4.0
Knox	48	2	30.0	1.88	5.3
Kokomo	51	6	31.4	1.70	2.5
Lafayette	51	4	30.6	1.66	2.1
Laporte		7	.....	1.29	4.8
Lima	49	12	29.2	1.40	2.8
Logansport	48	− 1	30.1	1.85	6.0
Madison	54	16	35.7	3.65	T.
Marengo	55	16	35.2	4.15	0.5
Marion	50	9	31.8	2.39	6.3
Markle	52	9	30.7	0.80	3.5
Mauzy	51	9	31.6	2.40	3.9
Moores Hill	49	11	33.5	2.22	0.7
Mount Vernon	57	14	35.8	3.72	0.2
Northfield	50	5	30.0	2.23	1.5
Paoli	56	11	35.5	3.24	T.
Princeton	55	12	35.4	3.15	T.
Rensselaer	54	0	29.8	1.48	6.5
Richmond	50	10	31.8	2.05	T.
Rochester	49	4	30.2	2.44	4.0
Rockville	52	6	32.2	2.01	T.
Rome	58	17	37.6	5.25	2.0
Salem	50	11	34.5	2.27	T.
Scottsburg	54	12	35.2	3.36	1.0
Seymour	54	16	35.8	2.85	
Shelbyville	49	12	31.4	2.20	T.
South Bend	51	6	29.6	1.50	7.0
Syracuse	51	5	29.7	2.21	8.5
Terre Haute	53	9	35.6	2.37	T.
Valparaiso	55	4	31.6	1.68	5.6
Veedersburg	55	.....	32.4[f]	.....	.....
Vevay	53	17	36.2	3.30	3.0
Vincennes	55	11	34.0	2.82	T.
Washington	53	11	34.0	3.42	T.
Indian Territory.					
Ardmore	60	21	38.4	3.63	T.
Calvin				1.81	
Durant	60	20	40.2	3.25	
Fairland	59	14	36.4	1.72	1.5
Fort Gibson				2.12	
Hartshorne		19	.....	3.05	
Healdton	61	10	38.1	3.46	T.
Holdenville	59	21	39.2	1.34	
Marlow	60	19	38.0	2.54	3.0
Muskogee	60	18	38.4	1.66	
Okmulgee	60	12	37.6	1.13	
Pauls Valley	63	16	38.4	1.95	
Ravia	60	21	40.4	3.64	1.0
South McAlester	61	21	41.4	2.36	
Tulsa				0.83	
Vinita	59	.....	37.2[e]	2.08	0.5
Wagoner	58	16	38.0	1.57	
Webbers Falls	58	15	38.5	2.44	
Iowa.					
Afton	51	− 1	27.4	0.25	2.5
Albia	56	− 3	27.0	1.08	11.0
Algona	47	− 5	25.2	0.20	2.0
Allerton	57	− 2[e]	28.6[e]	0.61	6.1
Alta	49	− 4	25.5	0.15	1.5
Alton	49	− 1	26.6	0.03	0.2
Amana	50	− 5	27.0	0.97	6.6
Ames	57	4	28.2	0.23	4.0
Atlantic	55	− 8	28.2	0.10	1.0
Audubon	53	− 5	27.2	0.15	1.5
Baxter	53	− 2	26.6	0.30	3.0
Bedford	51	− 4	26.6	0.15	1.2
Belleplaine	49	− 6	25.2	0.65	6.5
Bonaparte	57	− 3	29.2	0.83	4.0
Boone	53	− 1	26.9	0.41	5.5
Britt	47	− 7	23.8	0.37	3.7
Buckingham				0.69	7.0
Burlington	55	3	31.3	1.35	2.0
Carroll	54	− 6	26.6	0.27	2.7
Cedar Rapids	52	−10	25.6	0.52	4.2
Chariton	55	− 3	28.3	0.65	7.0
Clarinda	56	− 2	27.9	0.19	2.0
Clearlake	44	− 1	24.4	0.30	3.0
Clinton	52	1	27.4	1.42	4.1
College Springs	53	3	30.2	0.03	0.3
Columbus Junction	54	− 2	28.4	1.22	7.8
Corning	52	− 3	27.8	0.20	2.0
Corydon	57	− 3	29.4	0.68	7.0
Creston	52	− 1	28.9	0.35	3.5
Cumberland				0.04	0.4
Decorah	47	− 8	25.2	1.26	8.5
Delaware	48	− 5	24.0	0.94	9.5
Denison	54	− 6	28.4	0.12	1.2
Desoto	57	− 5	27.6	0.47	4.7
Dows	51	− 7	24.6	0.34	3.5
Elkader	56	−10	25.1	1.05	11.0
Elliott	51	− 5	28.1	0.13	1.2
Estherville	52	− 5	24.4	.....	.....
Fayette	44[l]	−10[l]	20.8[l]	0.94	8.5
Florence				0.35	3.5
Forest City	48	− 7	24.8	0.30	3.0
Fort Dodge	50	− 3	25.2	0.25	2.5
Fort Madison				1.10	1.5
Galva	50	− 4	26.5	0.08	0.8
Gilman				0.40	4.0
Glenwood	54	− 2	31.0	0.05	0.5
Grand Meadow	45	− 5	23.9	0.89	9.0
Greenfield	51	− 4	27.4	0.21	2.6
Grinnell	52	− 4	26.9	1.00	9.8
Grundy Center	51	− 8	25.2	0.71	7.0
Guthrie Center	53	− 4	27.8	0.95	.....
Hampton	54	− 2	26.5	0.57	5.1
Hancock	52	− 2	29.2	0.08	T.
Hanlontown	47	− 8	24.2	0.40	4.0
Harlan	53	− 6	26.4	0.05	1.0
Hopeville	54	0	29.4	0.18	.....
Humboldt	48	− 4	25.6	0.10	1.0
Ida Grove	50	− 7	27.4	0.10	1.0
Independence	50	− 4	25.5	0.93	9.3
Indianola	56	− 2	28.8	0.66	6.2
Iowa City	51	−10	24.2	1.04	5.3
Iowa Falls	49	− 6	24.6	0.47	4.7
Jefferson	62	− 1	30.0	0.06	0.5
Keosauqua	56	0	28.0	1.04	5.0
Knoxville	56	0	28.9	0.85	8.5
Lacona				0.92	12.6
Larrabee	51	− 4	26.2	0.17	2.4
Leclaire				1.38	2.1
Lemars	51	− 2	26.8	0.10	1.0
Lenox	51	− 3	28.0	0.18	1.8
Leon	52	− 2	28.8	0.39	3.9
Little Sioux	57	− 2	30.0	0.05	0.5
Logan	52	− 4	28.2	0.20	2.0
Maple Valley				0.25	2.5
Maquoketa	53	− 7	24.8	1.58	4.0
Marshalltown	52	− 1	26.4	0.56	5.2
Mason City	48	0	26.1	0.45	4.5
Monticello	54	−11	24.4	1.38	13.2
Mountayr	56	0	29.7	0.38	4.5
Mount Pleasant	51	0	28.4	1.28	5.5
Mount Vernon	53	− 7	26.3	1.47	10.5
Muscatine				0.97	6.1
New Hampton	48	− 6	23.8	0.56	5.0
Northwood	45	− 6	23.6	0.56	5.5
Odebolt	50	− 2	27.6	0.06	1.0
Ogden	52	− 2	27.1	0.50	5.0
Olin	50	− 9	26.2	1.54	6.8
Onawa	56	− 1	29.6	0.10	1.0
Osage	46	− 4	23.8	0.55	5.5
Oskaloosa	54	− 6	27.6	0.84	8.4
Ottumwa	57	1	28.8	1.69	6.1
Pacific Junction	51	− 5	28.6	0.07	0.7
Pella	55	− 1	29.0	0.86	8.2
Perry	55	− 3	26.8	0.45	4.5
Plover	48	− 4	25.9	0.15	1.5
Pocahontas	49	− 2	25.2	0.21	2.2
Redoak	55	0	32.4	0.06	2.0
Ridgeway	53	− 5	26.2	1.27	7.4

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Iowa—Cont'd.	°	°	°	*Ins.*	*Ins.*
Rock Rapids	48	— 2	25.4	T.	T.
Rockwell City	50	— 1	27.7	0.05	0.5
Sac City	52	— 3	26.6	0.17	1.8
St. Charles	61	0	31.1	0.52	5.2
Sheldon	56	— 4	27.4	0.10	1.0
Sibley	57	— 9	24.1	0.17	1.7
Sidney	50	— 3	27.6	0.15	1.5
Sigourney	53	— 4	28.1	1.06	8.5
Sioux Center	52	— 2	26.4	0.25	2.5
Stockport	54	— 1	29.0	0.63	7.0
Storm Lake	50	— 2	25.0	0.26	2.6
Thurman	53	— 5	28.8	0.10	1.0
Tipton	50	— 3	28.5	0.93	9.2
Toledo	52	— 5	26.9	0.20	3.0
Vinton	52	— 5	26.4	0.68	6.8
Wapello	59	— 8	30.9	1.23	4.0
Washington	54	— 4	28.4	1.05	.....
Washta	52	— 1	26.4	0.10	1.0
Waterloo	54	— 4	26.9	0.73	7.2
Waukee	54	— 1	27.4	0.85	8.5
Waverly	49	— 5	25.0	0.81	8.0
Webster City	50	4	26.9	0.30	3.0
Westbend	48	1	25.9	0.15	1.5
Whitten	48	— 7	25.1	0.60	6.0
Wilton Junction	50	— 5	26.8	1.50	10.0
Winterset	53	— 1	27.4	0.46	4.7
Woodburn	53	.....	.....	0.37	5.5
Zearing	54	— 9	26.2	0.41	3.5
Kansas.					
Abilene	.....	.....	.....	T.	T.
Alton	63[c]	6[d]	31.8[c]	T.	T.
Anthony	.....	.....	.....	T.	T.
Atchison	59	5	32.0	0.19	2.5
Baker	56	6	30.4	0.25	2.0
Burlington	59	7	33.6	0.16	2.0
Chapman	55[b]	10	32.4[f]	T.	T.
Clay Center	57	7	32.4	0.09	T.
Colby	64	5	30.8	T.	T.
Columbus	55	11	34.0	1.53	4.0
Cottonwood Falls	58	8	32.5	T.	T.
Cunningham	.....	11	.....	T.	T.
Dresden	66	8	33.0	0.00	
Eldorado	56	13	34.3	T.	T
Ellinwood	58	14	33.1	0.35	0.5
Ellsworth	55	9	31.6	0.20	1.5
Emporia	59	10	33.4	0.20	2.0
Englewood	63	9	34.4	0.00	
Enterprise	58	9	32.6	0.02	T.
Eureka	.....	.....	.....	0.08	1.0
Fall River	58	9	34.2	0.23	2.0
Farnsworth	64	7	32.2	T.	T.
Forsha	59	15	34.6	T.	T.
Fort Leavenworth	60	8	32.9	0.32	3.2
Frankfort	57	4	32.0	0.02	0.2
Garden City	60	7	32.6	0.05	0.5
Gove[e1]	60	10	32.4	0.00	
Grenola	56	8	32.7	T.	T.
Harrison	57	4	30.6	0.05	0.5
Horton	56	5	31.7	0.07	1.0
Hoxie	60[c]	4[c]	32.6[c]	0.00	
Hutchinson	60	14	34.0	0.12	1.0
Independence	55	14	35.5	0.68	1.8
Iola	55	12	34.2	0.40	2.5
Jewell	58	6	32.4	0.08	1.5
La Cross	57[c]	11	32.9[c]	0.04	1.0
Lakin	56	8	30.5	T.	T.
Larned	60	9	32.4	0.12	1.8
Lebo	57	8	32.7	0.10	1.0
Macksville	59	11	32.7	T.	T.
McPherson	55	15	33.2	0.12	1.0
Madison	59	8	32.2	0.03	
Manhattan[b]	57	6	33.4	T.	T.
Manhattan[c]	50	7	32.9	T.	T.
Marion	.....	.....	.....	T.	T.
Medicine Lodge	60	12[c]	34.4[b]	T.	T.
Minneapolis	56	10	32.3	0.15	1.5
Moran	56	10	34.4	0.45	1.1
Mounthope	57	.....	.....	T.	T.
Neosho Rapids	.....	.....	.....	0.07	1.0
Ness City	.....	.....	.....	0.02	0.2
Newton	57	11	34.1	0.04	0.3
Norton	65	2	30.6	T.	T.
Norwich	57	13	35.0	0.14	T
Oberlin	.....	.....	.....	0.00	
Osage City	60	.....	33.9[b]	0.13	1.1
Oswego	56	11	34.4	1.44	3.0
Ottawa	62	5	32.2	0.22	0.3
Pittsburg	56	12	34.3	0.77	3.5
Pleasanton	54	8	33.0	0.76	0.2
Pratt	55	12	33.8	0.04	1.0
Republic	58	3	30.8	0.10	1.0
Rome	58	10	34.7	0.36	1.0
Russell	62	11	33.1	T.	T.
Salina	60	10	32.3	0.10	1.0
Sedan	56	13	34.8	0.43	T.
Toronto	54	7	30.1	0.50	2.0
Ulysses	65[c]	9[d]	32.4[d]	0.06	
Valley Falls	67	4	32.6	0.20	2.2

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Kansas—Cont'd.	°	°	°	*Ins.*	*Ins.*
Wakeeney	62	11	33.2	0.00	
Wakeeney (near)	.....	.....	.....	0.00	
Wallace	65	2	30.8	0.03	1.0
Walnut	55	11	35.4	1.34	
Wamego[e1]	57	9	32.1	T.	T.
Winfield	54	14	33.7	0.08	T.
Kentucky.					
Alpha	60	17	41.2	6.12	0.5
Anchorage	55	16	34.8	4.96	6.0
Bardstown	55	18	37.0	4.37	0.5
Beattyville	58	15	36.2	3.93	0.2
Beaver Dam	57	16	37.4	4.74	1.0
Berea	54	16	39.0	4.61	T.
Blandville	55	17	36.6	4.69	T.
Bowling Green	56	17	38.0	3.55	1.0
Burnside	66	19	39.2	5.01	T.
Cadiz	57	17	38.8	4.78	T.
Calhoun	57	18	38.0	4.87	T.
Catlettsburg	58	18	37.6	3.54	T.
Earlington	56	16	36.4	5.12	0.5
Edmonton	53	13	37.6	4.72	T.
Eubank	55	14	36.1	3.21	0.8
Falmouth	.....	.....	.....	4.25	4.0
Farmers	54	13	36.2	3.67	1.5
Frankfort	54	20	38.2	4.16	0.5
Franklin	56	20	38.8	2.60	
Greensburg	63	11	36.2	4.68	
High Bridge	55	19	37.2	3.68	T.
Hopkinsville	57	16	37.9	4.94	T.
Irvington	55	17	36.8	5.15	1.2
Jackson	64	18	40.7	4.07	1.0
Leitchfield	55	16	36.6	5.22	1.5
Loretto	59	13	38.1	4.28	.....
Marion	59	16	37.2	4.99	.....
Maysville	57	17	35.6	3.95	1.5
Middlesboro	58	14	39.2	4.45	2.0
Mount Sterling	52	20	37.1	3.89	0.8
Owensboro	57	19	38.0	4.69	1.1
Owenton	52	18	35.4	4.73	5.0
Paducah	60	19	38.4	4.20	T.
Richmond	54	19	37.2	4.27	
St. John	58	15	35.3	5.13	0.1
Scott	57	14	35.3	3.77	2.0
Shelby City	53	12	35.6	4.23	T.
Shelbyville	54	17	35.4	4.16	2.0
Taylorsville	54	17	36.2	5.39	0.5
West Liberty	57	18	38.0	2.00	.....
Williamsburg	60	16	39.9	4.89	T.
Williamstown	55	15	35.6	3.63	4.5
Louisiana.					
Abbeville	75	27	47.4	4.46	
Alexandria	69	25	44.6	3.92	
Amite	71	24	46.6	5.30	
Burnside	75	26	48.8	6.86	
Calhoun	.....	.....	.....	4.99	T.
Cameron	65	29[b]	49.2[c]	4.98	
Clinton	71	24	46.3	4.33	
Collinston	68	24	42.4	4.27	
Covington	72	25	45.8	6.50	
Donaldsonville	77	26	50.4	5.95	
Farmerville	68	26	45.6	7.11	2.0
Franklin	76	28	48.8	5.33	
Georgetown	65	21	43.6	4.28	
Grand Coteau	74	27	48.0	4.66	
Hammond	73	25	47.2	7.34	
Houma	74	27	49.4	8.82	
Jennings	74	28	48.2	2.88	
Lafayette	73	26	47.0	3.82	
Lake Charles	75	28	48.4	5.60	
Lakeside	75	31	48.4	2.54	
Lawrence	75	33	51.3	4.51	
Libertyhill	66	23	43.2	6.01	4.0
Logansport	.....	.....	.....	6.56	0.5
Melville	72	24	44.2	3.93	
Minden	60	23	41.0	8.03	
Monroe	68	24	46.1	4.29	
Morgan City	.....	.....	.....	5.78	
New Iberia	72	29	49.2	4.30	
Opelousas	73	26	45.8	3.54	
Plain Dealing	62	23	41.6	10.05	2.5
Rayne	73	26	48.0	3.60	
Reserve	72	30	48.6	6.87	
Ruston[b]	68	19	43.2	.....	
Saint Francisville	78	26	49.0	3.62	
Schriever	79	28	48.8	.....	
Simmesport	.....	.....	.....	3.76	
Southern University	.....	.....	.....	12.62	
Sugar Experiment Station	73	29	50.6	13.64	
Sugartown	67	26	46.8	3.98	
Maine.					
Bar Harbor	54	3	29.1	7.61	16.5
Chesuncook	38	—10	17.0	2.22	26.5
Cornish	48	— 3	26.2	4.21	12.0
Danforth	.....	.....	.....	3.55	22.5
Debsconeag	42	—10	20.8	.....	.....
Fairfield	44	—12	24.0	3.19	15.0
Farmington	48	—14	24.2	2.69	17.0
Ft. Fairfield	44	—24	14.8	2.34	24.1

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Maine—Cont'd.	°	°	°	*Ins.*	*Ins.*
Gardiner	53	—11	26.0	3.12	.....
Greenville	38	—15	20.2[g]	1.22	16.0
Houlton	40	— 8	18.7	2.40	31.0
Lewiston	50	— 6	26.0	3.65	14.0
Madison	46	—12	23.2	3.45	13.0
Mayfield	48	— 2	23.7	2.69	19.0
Millinocket	46	—16	20.6	3.57	21.0
North Bridgton	52	— 8	26.9	2.95	13.0
Oquossoc	42	—11	20.0	1.47	22.5
Orono	48	—17	23.0	3.51	18.5
Patten	43	—15	20.2	2.00	26.0
Rumford Falls	42	— 9	24.4	2.98	15.4
The Forks	.....	.....	.....	2.40	19.5
Thomaston	51	— 9	25.4	.....	12.5
Vanburen	42	—28	14.8	2.60	21.0
Winslow	46	—13	24.4	2.82	9.0
Maryland.					
Annapolis	60	21	39.4	5.60	4.5
Bachmans Valley	56	7	35.6	5.11	5.5
Boettcherville	62	5	34.8	2.82	5.5
Cambridge	60	22	39.7	4.16	0.5
Cheltenham	58	15	36.3	5.27	3.0
Chestertown	58	21	38.0	3.53	3.0
Chewsville	57	3	34.4	2.59	8.5
Clearspring	60	8	34.1	4.18	7.0
Coleman	58	19	38.8	4.07	3.0
Collegepark	59	9	36.4	.....	2.5
Colora	.....	.....	.....	4.48	4.0
Cumberland	.....	.....	.....	3.17	4.5
Darlington	58	14	36.3	4.74	4.5
Deerpark	55	4	29.1	2.41	8.0
Easton	59	17	38.6	3.49	1.0
Fallston	59	12	36.5	5.46	4.0
Frederick	60	2	36.6	4.44	3.5
Grantsville	53	5	30.9	3.42	6.5
Greatfalls	61	9	36.2	.....	.....
Greenspring Furnace	57	9	34.4	3.33	7.0
Harney	.....	.....	.....	5.22	4.0
Jewell	60	16	38.3	5.04	2.0
Johns Hopkins Hospital	.....	.....	.....	4.29	5.5
Keedysville	58	3	35.0	3.83	8.0
Laurel	60	15	36.8	5.83	4.0
Mount St. Marys College	57	8	35.0	4.51	5.5
New Market	56	14	35.6	4.70	6.5
Oakland	52	8	31.2	2.59	4.5
Porto Bello	60	22	40.4	3.92	0.5
Princess Anne	62	16	38.7	5.30	T.
Solomons	58	23	38.6	3.84	0.5
Takoma Park	60	13	35.6	5.52	4.5
Van Bibber	55	16	37.2	5.07	.....
Westernport	55	11	34.8	3.04	6.0
Woodstock	56	16	36.2	.....	4.0
Massachusetts.					
Amherst	55	3	30.2	3.15	2.5
Bluehill (summit)	57	4	31.8	4.02	6.2
Cambridge	59	6	32.8	3.65	.....
Chestnuthill	60	9	33.0	4.27	7.0
Concord	57	3	30.0	4.24	11.0
East Templeton[e1]	50	0	28.8	3.15	6.8
Fallriver	60	11	34.6	4.28	3.0
Fitchburg	57	3	31.2	3.17	5.0
Framingham	58	2	30.9	4.02	7.8
Groton	51	— 2	28.2	3.81	7.0
Hyannis	.....	.....	.....	4.00	
Jefferson	.....	.....	.....	4.09	11.0
Lawrence	58	3	30.6	3.38	10.0
Leominster	.....	.....	.....	3.49	5.0
Ludlow Center	53	— 3	26.8	3.15	6.0
Middleboro	58	9	33.4	3.87	2.0
Monson	54	2	30.6	3.42	7.0
New Bedford	57	12	35.0	4.30	
Pittsfield	.....	.....	.....	2.51	6.2
Plymouth	58	11	34.1	4.21	1.0
Princeton	.....	.....	.....	3.91	5.5
Provincetown	53	18	37.8	3.29	T.
Salem	.....	.....	.....	4.10	4.0
Somerset[e1]	60	6	33.3	4.14	4.0
Sterling	.....	.....	.....	3.40	6.5
Taunton	60	8	32.0	4.02	.....
Webster	.....	.....	.....	3.87	12.0
Westboro	61	3	32.3	3.78	8.0
Weston	58	3	30.6	3.83	8.5
Williamstown	53	3	29.6	1.93	5.8
Winchendon	.....	.....	.....	3.12	5.0
Worcester	58	8	32.2	2.86	9.6
Michigan.					
Adrian	56[c]	13[c]	31.8[c]	1.50	.....
Agricultural College	52	12	30.2	2.54	3.5
Allegan	46	13	28.1	.....	.....
Alma	46	10	29.7	1.04	5.5
Ann Arbor	52	11	29.7	1.61	4.1
Arbela	47	11	30.8	1.33	3.5
Baldwin	39	6	24.2	0.70	7.0
Ball Mountain	50	10	29.0	0.85	4.5
Baraga	.....	.....	.....	1.55	15.5
Battlecreek	50	12	29.4	1.14	7.5
Bay City	42	10	27.9	1.15	6.0
Benzonia	42	10	28.7	1.98	12.0

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Michigan—Cont'd.	°	°	°	*Ins.*	*Ins.*
Berlin	50	9	28.4	1.27	4.5
Big Rapids	48	9	28.5	2.20	14.5
Birmingham	49	11	29.8	2.08	3.9
Bloomingdale	60	8	30.0	2.22	8.2
Calumet	45	0	24.8	2.48	31.0
Cassopolis	46	10	28.9	1.30	4.0
Charlevoix	44[a]	12[a]	29.6[a]	1.10	11.0
Charlotte	49	7	29.0	.....	.....
Chatham	50	2	22.9	3.53	34.8
Cheboygan	46	4	27.5	1.80	17.0
Clinton	52	12	30.1	1.57	4.1
Coldwater	69	10	31.4	1.27	6.5
Concord	47	10	28.9	2.06	5.5
Deer Park	39	6	25.1	1.90	16.5
Detour	42	3	27.8	3.01	23.5
Dundee	48	13	31.4	1.62	T.
Eagle Harbor	47	6	27.4	1.47	.....
East Tawas	46	7	28.9	1.45	4.0
Eloise	47	13	30.0	1.58	1.8
Flint	49	9	30.0	1.40	4.0
Frankfort	.....	.....	.....	.....	5.0
Gaylord	.....	.....	.....	0.97	9.7
Gladwin	46	— 3	27.8	0.80	6.0
Grand Haven	46	11	31.5	2.00	7.8
Grand Marais	46	9	25.8	2.12	15.5
Grape	50	12	30.7	1.35	3.3
Grayling	45	— 1	26.2	1.45	13.0
Hagar	48	8	28.6	1.90	6.2
Harbor Beach	46	6	30.4	0.42	0.2
Harrison	45	3	26.8	0.80	8.0
Harrisville	47	11	29.6	2.15	11.7
Hastings	52	9	29.6	1.64	6.3
Hayes	55	10	30.4	1.25	12.5
Highland	.....	.....	.....	1.58	9.0
Holland	55	7	29.0	1.94	5.5
Humboldt	44	—26	18.6	1.90	19.0
Iron Mountain	47	— 9	25.5	1.03	10.2
Iron River	47[c]	—13[c]	20.3[c]	1.20	13.0
Ironwood	43	— 5	21.7	1.54	15.4
Ishpeming	42	—15	19.9	3.70	37.0
Ivan	45	3	27.4	1.05	14.5
Jackson	51	12	30.3	1.39	8.0
Jeddo	48	14	30.3	1.25	1.9
Kalamazoo	48	9	29.4	1.08	7.0
Lake City	.....	.....	.....	0.50	5.0
Lansing	50	12	29.8	1.56	9.7
Mackinac Island	43	12	30.8	2.07	17.4
Mackinaw City	.....	6	.....	.....	.....
Mancelona	40	10	25.6	0.84	8.0
Marine City	58	10	32.8	1.60	.....
Menominee	48	6	27.8	0.15	1.5
Mio	43	— 4	27.2	1.85	15.8
Mount Clemens	50	11	30.8	1.38	2.5
Montague	52	12	31.0	2.58	8.5
Mount Pleasant	.....	.....	.....	1.78	.....
Muskegon	.....	.....	.....	1.27	4.0
Newberry	.....	.....	.....	1.08	9.3
Old Mission	46	12	29.5	1.50	11.0
Olivet	46	10	28.7	2.26	6.6
Omer	47	2	28.0	1.40	6.5
Onaway	45	2	28.8	1.70	17.0
Ovid	50	10	29.6	0.95	3.5
Owosso	46[b]	11[d]	31.4[d]	0.75	7.5
Petoskey	50	11	31.8	1.75	17.5
Plymouth	49	10	30.2	0.90	3.2
Pontiac	52	10	29.8	0.99	2.4
Port Austin	48	10	32.8	.....	.....
Powers	49	— 4	22.4	1.00	10.0
Reed City	46[c]	5[c]	29.6[c]	0.70	7.0
Saginaw (W. S.)	49	11	30.4	1.55	5.2
St. James	42	14[b]	29.3[c]	1.93	7.3
St. Johns	50	12	30.4	1.30	8.0
St. Joseph	54	13	32.0	1.18	0.8
Slocum	48	8	29.0	1.40	.....
Somerset	50[d]	10[c]	28.6[c]	.....	.....
South Haven	49	9	29.7	1.65	3.0
Staunton	55	10	30.4	1.36	13.5
Thomaston	44[d]	—12[d]	22.0[d]	1.50	15.0
Thornville	48	8	31.3	1.73	4.5
Traverse City	46	13	30.8	2.71	12.0
Vassar	49	10	30.7	0.80	2.4
Wasepi	49	12	29.4	1.62	3.0
Webberville	49	11	28.8	1.57	7.7
Wetmore	45	— 7	22.3	2.30	23.0
Whitefish Point	42	10	27.2	2.08	12.9
Woodlawn	43	— 4	24.8	1.86	18.5
Ypsilanti	47	10	29.8	1.82	3.3
Minnesota.					
Albert Lea	48	— 5	28.8	0.30	3.0
Alexandria	43	—14	18.2	T.	T.
Amboy	55	— 6	25.5	0.10	0.8
Angus	37	—15	13.0	0.03	.....
Ashby	40	— 8	19.1	0.04	0.8
Beardsley	47	—11	21.3	T.	T.
Beaulieu	41	—16	16.4	T.	T.
Bemidji	45	—12	17.4	0.25	2.5
Bird Island	45	— 7	22.8	T.	T.
Caledonia	45	— 8	23.4	0.96	10.5

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Minnesota—Cont'd.	°	°	°	*Ins.*	*Ins.*
Collegeville	42	— 4	21.3	0.07	0.7
Crookston	35	—15	13.8	0.40	4.0
Detroit	39	—19	13.8	0.05	2.0
Faribault	46	— 5	23.1	0.09	3.0
Farmington	45	— 7	23.0	0.10	1.0
Fergus Falls	40	— 8	20.2	0.12	1.2
Glencoe	43	— 6	22.6	T.	T.
Grand Meadow	48	— 2	23.1	0.44	5.0
Hallock	36	—19	12.0	0.35	3.8
Hinckley	41	—17	18.2	.....	.....
Hovland	48	—20	21.5	0.17	2.0
Lake Winnibigoshish	45	— 8	17.7	0.00	
Leech	48	—15	16.8	0.20	3.0
Little Falls	40	—10	18.8	T.	T.
Long Prairie	42	—15	18.2	T.	T.
Luverne	47	— 2	24.0	0.10	1.0
Lynd	48	— 9	23.4	0.04	0.5
Mankato	.....	.....	.....	0.06	0.5
Mapleplain	42[f]	— 8[f]	22.4[f]	0.14	1.6
Milaca	39	—14	16.8	T.	T.
Milan	44	— 2	21.2	0.20	2.0
Montevideo	46	—12	22.0	0.07	0.9
Mora	43	—18	16.7	T.	T.
Morris	42	—12	19.2	0.08	1.0
Mount Iron	39	—20	16.4	0.20	2.0
New London	40	—15	17.6	T.	T.
New Richland	47	3[i]	27.0[c]	0.15	1.5
New Ulm	46	— 7	23.9	0.05	0.5
Park Rapids	40	—22	14.2	0.18	1.8
Peterson	.....	.....	.....	0.84	9.1
Pine River	41	—14	17.0	0.20	2.5
Pipestone	47	— 6	23.5	0.05	0.5
Pokegama Falls	47	—15	16.8	0.30	4.7
Redwing	45	— 2	25.0	0.30	4.0
Reeds	.....	.....	.....	0.13	4.3
Rolling Green	47	0	25.6	0.10	1.1
St. Charles	46	— 7	25.2	0.74	6.0
St. Cloud	48	—12	19.6	T.	T.
St. Peter	51	— 6	25.4	0.17	1.7
Sandy Lake Dam	43	—10	17.7	0.13	2.3
Shakopee	43	— 4	23.0	0.10	1.0
Thief River Falls	39	—12	14.6	T.	T.
Tonka	.....	.....	.....	T.	T.
Two Harbors	40	— 6	22.4	.....	.....
Wabasha	51	— 7	25.3	0.53	5.0
Wadena	42	—12	16.5	0.06	1.0
Willow River	43	—20	16.8	0.03	0.6
Windom	55[c]	— 3[i]	25.0[d]	.....	.....
Winnebago	51	— 5	24.8	0.11	1.3
Winona	45	— 4	23.4	0.59	5.8
Worthington	49	—10	24.6	0.05	0.5
Zumbrota	44	0	23.2	0.20	2.0
Mississippi.					
Aberdeen	66	19	40.2	5.54	
Austin	74	18	42.0	6.32	T.
Batesville	63	21	40.0	5.45	
Bay St. Louis	73	28	49.6	9.68	
Biloxi	71	29	50.2	8.85	
Booneville	.....	.....	.....	5.64	
Brookhaven	71	24	45.0	5.29	
Canton	71	20	43.8	3.49	
Columbia	.....	.....	.....	5.21	
Columbus	68	21	41.0	4.72	
Corinth	62	19	39.5	6.56	T.
Crystal Springs	70	24	45.0	4.00	
Duck Hill	66	21	40.8	4.49	
Edwards	70	23	43.2	5.03	
Enterprise	.....	.....	.....	5.08	
Fayette	71	24	43.8	5.75	
Fayette (near)	.....	.....	.....	6.17	
Greenville *a*	63	21	41.7	5.68	
Greenville *b*	66	21	42.0	6.15	
Greenwood	69	21	41.4	7.38	
Hattiesburg	73	23	45.0	8.13	
Hazlehurst	71	24	44.6	6.10	
Hernando	62	21	40.2	5.05	T.
Holly Springs	57	22	39.4	5.25	0.2
Indianola	67	20	41.4	4.33	T.
Jackson	71	23	43.2	5.00	
Kosciusko	69	20	42.6	5.16	
Lake	72	19	41.8	3.92	
Lake Como	72	24	46.6	3.88	
Laurel	.....	.....	.....	8.01	
Leakesville	73	19	45.4	7.53	
Leland	.....	.....	.....	5.21	
Louisville	69	21	43.5	4.30	
McNeill	74	25	48.2	7.25	
Macon	.....	.....	.....	4.35	
Magnolia	72	23	46.6	5.54	
Merrill	.....	.....	.....	6.37	
Natchez	71	26	47.1	9.30	
Nitta Yuma	62	21	40.0	4.95	
Okolona	64	20	40.5	.....	T.
Patmos	.....	.....	.....	4.41	
Pearlington	70	27	48.8	14.34	
Pecan	68	27	48.7	.....	
Pittsboro	70	19	40.6	4.47	
Pontotoc	67[b]	18[b]	39.9[c]	3.94	0.2

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Mississippi—Cont'd.	°	°	°	*Ins.*	*Ins.*
Port Gibson	71	22	42.8	5.44	
Porterville	71	18	43.4	5.10	
Quitman	75	20	45.1	8.10	
Shelby	64	19	42.0	5.63	
Shoccoe	74	21	44.5	3.99	
Shubuta	.....	.....	.....	8.31	
Stonington	.....	.....	.....	6.91	
Suffolk	71	23	45.6	4.14	
Tchula	69	20	43.2	5.30	
Tupelo	65	19	40.0	5.94	0.2
University	65	20	41.4	4.87	0.2
Utica	70	23	43.4	5.81	
Walnutgrove	71	21	45.0	4.56	
Walthall	.....	.....	.....	3.67	
Watervalley	68	20	41.0	4.72	T.
Waynesboro	70	18	44.0	6.30	
Woodville	70	26	46.0	4.10	
Yazoo City	73	22	44.0	4.60	
Missouri.					
Albany	.....	.....	.....	0.10	1.0
Appleton City	56	6	33.1	1.32	2.0
Arthur	66	8	35.9	1.14	1.0
Avalon	57	3	31.4	0.93	5.0
Bethany	52	2	29.4	0.27	2.0
Birchtree	59[c]	11[c]	35.8[c]	3.22	
Blue Springs	59[i]	3[f]	32.0[i]	0.54	1.4
Bolivar	60	8	34.5	1.63	1.7
Boonville	.....	.....	.....	1.26	0.2
Brunswick	59	6	30.7	0.99	.....
Caruthersville	62	17	38.2	4.64	T.
Conception	56	3	31.4	T.	T.
Darksville	55	5	33.2	0.95	3.0
Dean	56	11	36.0	2.53	1.6
Decaturville	55	5	33.6	1.20	T.
De Soto	61	9	36.1	1.78	T.
Doniphan	56	14	35.0	3.68	2.0
Downing	.....	.....	.....	0.75	6.0
Eldorado Springs	56	7	34.7	1.25	2.0
Fairport	.....	.....	.....	0.40	4.0
Fayette	55	6	32.0	0.98	1.5
Fulton	58	9	32.6	1.05	.....
Gallatin *[i]	57	6	33.7	0.45	5.0
Gano	59	8	35.8	1.89	1.6
Glasgow	.....	.....	.....	0.91	
Goodland	61	10	34.1	2.04	0.5
Gorin	.....	.....	.....	0.90	3.1
Grant City	56	1	30.8	T.	T.
Harrisonville	56	5	31.3	0.88	4.0
Hazlehurst	.....	.....	.....	0.82	5.0
Hermann	.....	.....	.....	1.16	T.
Houston	59	10	35.0	2.34	1.4
Ironton	61	5	34.5	3.24	T.
Jackson	60	14	37.2	3.50	T.
Jefferson City	59	8	33.4	0.92	0.2
Joplin	57	19[i]	37.9[f]	1.28	
Kidder	55	4	30.3	0.48	4.0
Koshkonong	59	11[c]	35.8	4.12	T.
Lamar	55	11	34.8	1.71	3.0
Lamonte	.....	.....	.....	0.92	1.0
Lebanon	54	8	33.4	1.06	T.
Lexington	60	7	33.0	0.92	5.0
Liberty	60	5	32.7	0.44	0.7
Lockwood	54	8	33.4	2.30	2.0
Louisiana	56	8	32.7	1.57	0.5
Macon	56	6	32.3	1.15	4.5
Marblehill	59	13	36.0	3.24	0.7
Marshall	54	7	32.0	0.96	1.5
Maryville	52	2	28.8	0.15	1.5
Mexico	56	8	32.8	0.86	0.5
Monroe	53	6	31.1	1.17	0.2
Mountain Grove	56	9	33.9	2.57	1.5
Mount Vernon	55	9	33.2	1.20	2.0
Neosho	59	10	35.3	2.20	2.0
New Haven	59	12	35.6	1.52	T.
New Madrid	.....	.....	.....	5.02	.....
New Palestine	60	9	35.7	0.67	0.2
Oakfield	60	11	35.2	2.02	1.1
Olden	61	7	35.2	3.70	T.
Oregon	50	4	30.8	0.15	1.5
Osceola	.....	.....	.....	1.19	
Pine Hill	.....	.....	.....	3.18	T.
Princeton	52	3	31.0	0.65	5.0
Protem	59	10	35.8	2.73	
Rockport	.....	.....	.....	0.07	0.5
Rolla	.....	.....	.....	1.31	1.2
St. Charles	59	11	34.6	2.34	T.
St. Joseph	.....	.....	.....	0.20	2.0
Sarcoxie	.....	.....	.....	2.44	2.7
Sedalia	55	11	33.7	1.15	0.5
Seymour	55	7	33.4	1.76	1.3
Sikeston	55	17	36.8	4.04	T.
Steffenville	56	8	31.8	1.10	1.5
Sublett	53	4	29.8	1.10	6.0
Trenton	52	6	30.8	0.54	4.0
Unionville	55	— 2	27.4	1.41	11.1
Versailles	60	6	33.4	1.30	T.
Warrensburg	58	7	34.4	0.97	.....
Warrentou	57	8	32.0	1.36	0.9

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Missouri—Cont'd.	°	°	°	*Ins.*	*Ins.*
Warsaw	58	7	33.6	1.41	2.0
Wheatland	.....	.....	.....	1.47	3.0
Willowsprings	56	8	32.6	3.40	T.
Windsor	63	5	33.6	0.94	0.8
Zeitonia	61	10	34.2	2.72	T.
Montana.					
Absarokee	.....	.....	.....	0.15	1.5
Anaconda	50	7[d]	28.0[e]	0.05	.....
Augusta	56	−10	32.0	0.10	1.0
Billings	52	0	31.6	0.07	1.5
Boulder	47	2	23.1	T.	T.
Bozeman	43	2	23.0	0.38	5.6
Butte	46	4	23.9	0.15	1.5
Canyon Ferry	40	− 2	20.5	0.00	
Cascade	.....	.....	.....	0.20	2.0
Choteau	58	− 9	33.6	T.	T.
Columbia Falls	46	3	25.1	2.79	9.5
Copper	.....	.....	.....	0.18	2.2
Crow Agency	50	− 6	25.0	T	T.
Culbertson	42	−24	13.6	0.07	1.0
Dayton	42	10	27.0	0.74	4.8
Decker	45	− 6	17.1	0.00	
Deerlodge	39[d]	− 9[e]	18.6[d]	.....	.....
Dillon	44	− 1	25.8	0.09	0.8
Ekalaka	53	−10	26.6	0.30	3.0
Fallon	46	−18	20.2	T.	
Forsyth	48	−12	22.9	0.10	1.0
Fort Benton	44	−12	26.4	0.60	6.0
Fort Harrison	40	0	20.8	.....	
Fort Logan	48	− 8	19.2	0.00	
Glasgow	40	−16	13.2	0.17	.....
Glendive	.....	.....	.....	0.28	2.0
Gold Butte	.....	.....	.....	0.12	1.0
Graham	56	−11	25.8	T.	T.
Grayling	38	−36	6.6	0.69	8.2
Greatfalls	51	−16	31.4	0.18	1.8
Hamilton	.....	.....	.....	0.35	10.0
Highwood	.....	.....	.....	0.05	T.
Homepark	.....	.....	.....	0.80	5.5
Lakeview	.....	.....	.....	T.	T.
Lewistown	55	− 3	29.5	0.00	
Livingston	54	14	32.2	0.25	3.0
Lodge Grass	.....	− 5[f]	23.0[f]	T.	T.
Malta	40	−19	16.4	0.04	0.4
Marysville	43[c]	.....	25.6[c]	.....	.....
Missoula	40	1	21.2	0.23	2.5
Nye	.....	.....	.....	0.06	1.0
Ovando	42	− 8	16.4	0.62	5.8
Philipsburg	55	− 2	27.4	0.20	1.0
Plains	55	9	26.8	0.30	3.0
Poplar	44	−24	14.9	T.	
Raymond	.....	.....	.....	T.	T.
Redlodge	52	− 3	25.6	0.06	1.5
Ridgelawn	42	−16	18.6	0.00	
St. Pauls	61	− 3	31.2	0.16	2.0
St. Peter	53	2	31.7	0.07	1.0
Saltese	.....	.....	.....	0.37	3.8
Springbrook	52	−18	24.8	0.30	3.0
Steele	55	− 5	33.4	0.17	1.8
Tokna	46	−20	20.6	T.	0.1
Troy	45	4	28.3	2.08	13.0
Utica	55	4	31.2	T.	T.
Virginia City	48	1	23.0	0.28	2.9
Warrick	.....	.....	.....	0.13	1.3
Whitelash	.....	.....	.....	0.01	
Wolf Creek	49	8	30.2	0.01	0.1
Wolsey	42	−15	18.2	0.26	4.5
Yale	48	1	27.2	0.00	
Nebraska					
Agate	57	−10	22.2	0.05	1.0
Agee[*1]	56	.....	26.4[c]	T.	T.
Ainsworth	58	− 8	31.2	T.	T.
Albion	60[c]	− 3[c]	28.4[c]	T.	T.
Alliance	54	− 5	24.2	T.	0.2
Alma	63	6	31.0	0.00	
Arcadia	.....	.....	.....	T.	T.
Ashland	55	− 1	31.0	0.14	1.1
Ashton	.....	.....	.....	T.	
Auburn	59	0	32.0	0.05	0.5
Aurora	56	2	31.2	0.10	1.0
Bartley	65	2	32.0	0.00	
Beatrice	55	− 1	29.7	0.10	1.0
Beaver	57	7	31.6	0.00	
Bellevue	54[b]	− 1	31.0[d]	0.10	1.0
Benkleman	.....	.....	.....	T.	T.
Blair	53	− 2	30.0	0.06	0.6
Bluehill	.....	.....	.....	0.00	
Bradshaw	.....	.....	.....	0.00	
Bridgeport	60	− 2	29.0	0.00	
Broken Bow	63	− 2	30.7	0.00	
Burge	.....	.....	.....	T.	T.
Burwell	.....	.....	.....	T.	T.
Callaway	64	0	31.6	T.	T.
Central City	.....	.....	.....	T.	T.
Chester	.....	.....	.....	0.00	
Clearwater	62	− 4	29.8	T.	T.
Columbus	58	− 2	28.1	0.02	0.2
Crawford	.....	.....	.....	T.	T.
Crete	58	1	30.0	0.08	1.0
Culbertson	63	7	31.6	0.00	
Curtis	58	5	29.6	0.00	
David City	52	− 1	31.2	0.02	0.2
Dawson	58	2	31.3	T.	T.
Dubois	.....	.....	.....	T.	T.
Duff	.....	.....	.....	0.05	0.5
Dunning	.....	.....	.....	0.00	0.0
Edgar	.....	.....	.....	0.00	0.0
Ericson	.....	.....	.....	T.	T.
Ewing	.....	.....	.....	0.00	
Fairbury	60	− 4	29.8	0.08	1.5
Fairmont	58	2	30.0	T.	
Fort Robinson	60	− 3	26.8	0.20	2.0
Franklin	59	9	36.4	0.00	
Fremont	61	− 1	29.8	0.02	0.2
Fullerton	.....	.....	.....	0.05	0.5
Geneva	57	2	31.8	T.	T.
Genoa (near)	55	− 5	30.6	0.04	1.0
Gering	58	0	23.6	T.	T.
Gordon	.....	.....	.....	0.00	
Gosper	.....	.....	.....	0.00	
Gothenburg	61	2	30.4	0.00	
Grand Island	54	3	30.8	0.00	
Grant	61	− 2	29.0	0.00	
Greeley	.....	.....	.....	0.00	
Guide Rock	.....	.....	.....	0.05	0.5
Haigler	.....	.....	.....	0.00	
Halsey	60	− 5	28.6	T.	T.
Hartington	55	− 8	29.6	T.	T.
Harvard	57	3	29.2	0.02	0.2
Hastings[*1]	56	5	31.2	0.05	0.5
Hayes Center	61	4	32.1	0.00	
Hay Springs	56	−14	25.2	0.20	2.0
Hebron	56	3	30.6	0.07	0.8
Hendley	.....	.....	.....	0.00	
Hickman	.....	.....	.....	0.00	
Holbrook	.....	.....	.....	T.	T.
Holdrege	58	5	30.8	0.00	
Hooper[*1]	52	0	28.6	0.07	0.5
Imperial	61	0	29.0	0.05	0.5
Johnstown	.....	.....	.....	0.00	
Kearney	59	7	32.0	0.00	
Kennedy	55	− 7	30.0	0.00	
Kimball	60	4	28.2	0.00	
Kirkwood	62	− 8	31.5	0.00	
Leavitt	60	0	29.4	0.00	
Level	.....	.....	.....	0.00	
Lexington	62	1	30.2	0.00	
Loup	60	0	30.4	0.00	
Lynch	62	−10	31.4	0.00	
McCook	.....	.....	.....	0.00	
McCool	.....	.....	.....	0.04	0.5
Madison	60	− 2	30.5	0.05	0.5
Marquette	.....	.....	.....	0.05	0.5
Mason	.....	.....	.....	0.00	
Minden	59	6	30.8	0.03	0.3
Monroe	.....	.....	.....	0.09	1.0
Nebraska City	57	− 3	31.0	0.15	1.5
Nemaha	.....	.....	.....	0.10	1.0
Norfolk	62	− 3	30.0	T.	T.
North Loup	62	− 1	29.4	T.	T.
Oakdale	59	− 3	28.6	T.	T.
Oakland	58	− 5	28.4	0.10	0.5
Odell	.....	.....	.....	0.02	0.2
Ord	.....	.....	.....	0.00	
Osceola	.....	.....	.....	0.00	
Palmer	.....	.....	.....	0.10	1.0
Palmyra[*1]	58	− 2	30.3	0.08	0.5
Pawnee City	60	1	31.3	0.05	0.5
Plattsmouth	.....	.....	.....	0.10	1.0
Plymouth	57	2	32.6	0.10	1.0
Purdum	59	− 8	30.2	T.	T.
Ravenna	62	3	30.8	T.	T.
Republican	.....	.....	.....	0.00	
St. Libory	.....	.....	.....	T.	T.
St. Paul	60	0	31.6	T.	T.
Santee	60	− 5	31.0	0.00	
Schuyler	.....	.....	.....	0.05	0.5
Seneca	.....	.....	.....	0.00	
Seward	59	1	29.5	T.	T.
Smithfield	.....	.....	.....	0.00	
Springview	55	−10	31.0	0.00	
Stanton	60	− 5	29.6	0.10	1.0
Strang	.....	.....	.....	T.	T.
Stratton	.....	.....	.....	0.00	
Stromsburg	.....	.....	.....	0.00	
Superior	55	0	28.6	0.05	0.5
Syracuse	.....	.....	.....	0.05	0.5
Tablerock	.....	.....	.....	0.05	0.5
Tecumseh	58	5	30.2	T.	0.1
Tekamah	58	− 2	29.9	0.10	1.0
Turlington	55	0	30.8	0.15	1.5
University Farm	57	− 1	31.7	0.05	1.0
Wahoo	.....	.....	.....	0.05	0.5
Wakefield	58	− 4	28.8	0.03	0.3
Wallace	.....	.....	.....	0.00	
Wauneta	.....	.....	.....	0.00	
Nebraska—Cont'd.	°	°	°	*Ins.*	*Ins.*
Weeping Water	.....	.....	.....	0.12	1.5
Westpoint	61	2	30.4	T.	T.
Whitman	.....	.....	.....	T.	T.
Wilber	.....	.....	.....	0.00	
Wilsonville	.....	.....	.....	0.00	
Winnebago	57	− 8	28.0	T.	T.
Wisner	.....	.....	.....	0.02	.....
Wymore	.....	.....	.....	0.02	0.2
York	60	2	30.0	0.05	0.5
Nevada.					
Amos	46	1	20.4	0.35	3.5
Austin	50	− 2	22.4	0.73	
Battle Mountain	51	−16	21.7	0.70	7.0
Carlin[*1]	45	−10	19.7	1.10	11.0
Carson City	52	− 1	26.6	0.22	4.2
Cranes Ranch	.....	.....	.....	1.44	
Dyer	52	− 6	25.6	0.00	
Elko	50	−10	19.0	0.55	5.5
Eureka	59	5	31.0	1.60	16.0
Fenelon	64	− 4	19.6	0.70	7.0
Geyser	48	−10	19.9	T.	T.
Hazen	52	− 7	26.9	0.12	1.2
Humboldt	42	− 9	17.8	0.32	10.0
Lewers Ranch	49	7	28.6	0.88	8.8
Lovelocks	45	− 8	19.0	0.15	1.5
Martins	68	0	31.4	0.10	1.0
Mill City[*1]	44	−14	20.6	1.20	12.0
Morey	57	− 3	26.6	0.16	1.2
Palisade	64	−16	18.6	0.90	9.0
Palmetto	58	−10	25.2	0.60	6.0
Pioche	51	− 7	23.1	0.10	1.0
Potts	40	−21	12.2	0.45	4.0
San Jacinto	44[b]	−15	21.4[d]	0.60	6.0
Tecoma	47	− 9	21.0	1.40	14.0
Verdi[*1]	42	1	18.5	1.00	10.0
Wabuska	55	− 4	24.2	0.10	1.0
Wadsworth	54	− 3	27.5	0.50	5.0
Wells	42	−14	18.1	1.20	12.0
Wood	44	−14	19.2	1.26	19.0
New Hampshire.					
Alstead	46	− 1	27.2	3.25	7.2
Bartlett	.....	.....	.....	4.05	13.0
Bethlehem	46	− 7	28.2	3.64	18.5
Brookline[*1]	56	− 2	31.8	4.01	6.5
Durham	54	− 7	28.8	7.41	5.0
Franklin Falls	50	− 4	26.9	3.86	11.5
Grafton	47	−10	25.0	2.75	8.0
Hanover	47	−12	24.2	2.34	7.8
Jefferson Highlands	.....	.....	.....	2.68	12.0
Keene	51	− 4	27.2	3.25	6.2
Littleton	45[c]	− 9	24.6[c]	4.90	.....
Nashua	56	2	29.2	4.05	8.0
Newton	58	− 7	29.0	3.66	8.0
North Woodstock	.....	.....	.....	2.14	.....
Plymouth	43	−11	23.8	3.22	12.5
Stratford	43	−17	22.3	3.23	15.0
New Jersey.					
Asbury Park	57	17	38.2	4.07	4.5
Bayonne	60	15	36.9	2.99	0.5
Belvidere	55	12	33.4	2.82	T.
Bergen Point	59	15	36.4	3.29	0.5
Beverly	60	15	36.8	3.62	2.2
Bridgeton	60	15	38.0	4.88	2.5
Browns Mills	61	7	35.2	3.96	3.0
Canton	.....	.....	.....	3.32	3.0
Cape May C. H.	61	14	39.0	4.43	1.0
Charlotteburg	55	9	33.0	4.14	0.2
Clayton	60	10	36.8	4.23	5.0
College Farm	60	13	36.0	3.39	T.
Dover	55	13	32.4	3.90	T.
Elizabeth	56	15	37.0	3.27	T.
Englewood	57	14	35.0	4.10	4.0
Flemington	58	17	35.7	3.00	.....
Friesburg	59	13	37.0	3.49	3.0
Hightstown	60	12	35.6	3.64	0.8
Imlaystown	61	16	38.3	3.36	3.0
Indian Mills	60	10	37.4	4.26	3.0
Lakewood	61	13	37.3	4.22	2.5
Lambertville	59	16	36.1	3.46	
Layton	52	5	31.2	2.97	T.
Moorestown	61	15	36.6	3.59	2.6
Newark	59	15	36.7	3.23	0.4
New Brunswick	60	16	36.8	3.33	T.
Newton	59	11	33.9	3.17	1.3
Oceanic	60	18	34.7	3.41	0.7
Paterson	57	17	37.4	4.23	0.4
Phillipsburg	56	15	34.6	2.73	0.1
Plainfield	60	15	35.4	3.57	0.7
Pleasantville	.....	.....	.....	2.76	2.0
Rancocas	.....	.....	.....	3.23	2.5
Rivervale	58	8	33.4	2.58	2.0
Sandy Hook	57	19	37.4	3.40	0.3
Somerville	59	13	35.3	2.68	T.
South Orange	59	16	35.5	3.66	T.
Sussex	54	11	34.0	2.78	1.0
Toms River	61	12	36.6	4.70	3.0
Trenton	57	16	39.6	3.23	T.
Vineland	60	12	36.6	4.28	4.0

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
New Jersey—Cont'd.	°	°	°	*Ins.*	*Ins.*
Woodbine	60	12	38.1	5.60	3.0
New Mexico.					
Alamagordo	60	13	36.4	0.86	7.0
Albert	62	11	37.0	T.	T.
Albuquerque	55	3	31.0	2.93	.....
Alma	62[j]	6[j]	36.6[j]	0.85	.....
Alto	.....	.....	.....	2.23	27.0
Artesia	61	11	36.0	0.80	3.0
Bellranch	59	8	33.5	0.78	3.0
Bloomfield	54	0	27.0	0.03	0.2
Brice	59	12	38.8	1.12	T.
Chama	47[g]	−13[g]	29.7[g]	0.80	8.0
Cimarron	59	− 5	29.4	0.04	0.5
Cliff	62	11	37.8	1.38	7.0
Cloudcroft	50	− 7	22.6	2.54	28.5
Datil	52	−18	24.2	2.10	21.0
Deming	58	11	35.2	0.98	8.0
Dorsey	59	0	29.0	0.60	
Eagle Rock Ranch	57	− 7	26.5	0.23	3.3
Elizabethtown	47	−15	17.1	0.08	0.5
Elk	65	− 2	33.7	1.17	17.0
Espanola	62	3	29.5	T.	T.
Fairview	.....	.....	.....	1.10	11.0
Fort Bayard	59	5	33.0	1.51	6.0
Fort Stanton	56	−14	28.5	1.80	18.0
Fort Union	73[e]	− 9[e]	29.6[e]	0.50	5.0
Fort Wingate	55	−11	25.6	1.00	10.0
Fruitland	47	− 6	26.3	0.15	1.5
Gran Quivira	.....	.....	.....	1.23	26.3
Hillsboro	55	4	34.6	1.72	19.0
Hope	.....	.....	.....	0.60	6.0
Laguna	44	−16	23.8	5.40	28.0
Lagunita	60	− 8	30.4	2.03	19.0
Lake Valley	.....	.....	.....	1.55	15.5
Las Vegas	58	− 9	28.0	0.68	6.5
Lordsburg	62	15	36.3	0.53	2.5
Los Alamos	.....	.....	.....	0.92	9.2
Los Lunas	51	6	31.0	0.65	5.5
Luna	50	−16	21.6	1.87	20.0
Magdalena	.....	.....	.....	1.50	14.0
Manuelito	.....	.....	.....	1.30	13.0
Mesilla Park	60	10	37.9	0.90	.....
Mimbres	.....	.....	.....	0.95	9.5
Mineral Hill	.....	.....	.....	0.61	9.5
Nara Visa	59	15	34.9	0.99	3.0
Palma	.....	.....	.....	1.10	11.0
Patterson	.....	.....	.....	0.51	6.1
Portales	61	− 4	32.8	1.03	5.5
Raton	56	1	27.8	0.08	0.8
Redrock	.....	.....	.....	1.46	6.0
Rincon	61	16	37.3	0.57	7.0
Rociada	46	−16	21.6	0.62	9.0
Rosedale	45	4	27.6	2.50	25.5
San Marcial	56	9	33.8	.....	.....
San Rafael	50	−10	26.0	1.88	20.5
Socorro	56	− 1	30.8	1.23	7.8
Strauss	.....	.....	.....	0.72	4.2
Taos	56	− 2	28.7	T.	T.
Trampas	.....	.....	.....	0.18	.....
Tres Piedras	49	−13	18.7	0.10	1.0
Tucumcari	60[l]	10[b]	34.7[l]	1.00	6.0
Valley	.....	.....	.....	T.	T.
Vermejo	60	− 9	25.1	T.	T.
Weed	.....	.....	.....	1.60	.....
Whiteoaks	.....	.....	.....	2.50	25.0
Windsor	56	−10	24.0	0.45	.....
New York.					
Adams	49	− 8	24.6	7.32	42.0
Addison	54	2	31.9	2.84	6.0
Akron	.....	.....	.....	3.08	.....
Amsterdam	55	1	29.5	3.48	4.0
Angelica	47	− 2	28.5	2.79	9.0
Appleton	54	10	33.0	2.48	.....
Arcade	48	− 6	27.8	3.15	31.5
Athens	57	7	31.8	2.89	2.0
Atlanta	49	− 1	29.4	2.27	8.0
Atwater	.....	.....	.....	3.00	8.3
Auburn	50	3	31.0	3.47	7.0
Avon	49	5	31.3	2.49	6.5
Baldwinsville	50	2	30.0[e]	2.16	8.0
Ballston Lake	54	3	28.8	2.60	4.0
Bedford	57	11	34.8	3.20	2.0
Berlin	53	− 3	29.0	3.62	8.0
Blue Mountain Lake	.....	.....	.....	3.92	28.5
Bolivar	50	0	29.0	3.12	9.5
Bouckville	48	−18	26.2	3.53	15.0
Brockport	50	6	32.2	2.81	7.0
Cape Vincent	46	− 6	27.8	4.20	T.
Carmel	55	9	31.2	3.96	4.5
Carvers Falls	46	−10	25.8	1.46	5.0
Chatham	58	4	31.4	2.55	4.0
Chazy	48	−20	22.6	1.45	13.5
Coeymans	58	6	31.2	2.07	T.
Cold Spring Harbor	57	16	35.0	5.15	T.
Cooperstown	50	2	28.4	3.15	4.0
Cortland	49	1	32.1	3.56	7.2
Cutchogue	57	16	36.2	4.10	T
Dekalb	52	−25	23.7	3.99	23.0
New York—Cont'd.	°	°	°	*Ins.*	*Ins.*
De Ruyter	50	−12	27.8	4.33	18.7
Easton	.....	.....	.....	3.64	3.0
Elba	47	5	30.4	2.11	1.8
Elmira	53	6	32.6	3.33	4.0
Faust	.....	.....	.....	2.09	19.0
Fayetteville	53	− 2	38.2	2.96	9.5
Fort Plain	52	6	30.6	2.70	1.5
Franklinville	50	− 5	28.2	3.32	9.1
Gabriels	46	−27	21.4	1.93	15.0
Gansevoort	.....	.....	.....	3.37	6.5
Glens Falls	49	0	27.8	2.44	6.8
Gloversville	48	0	26.8	4.63	8.0
Greenfield	55	− 1	28.2	2.72	T.
Greenwich	55	0	28.2	2.85	3.5
Griffin Corners	52	2	28.1	2.99	1.0
Harkness	47	−12	24.2	1.66	11.0
Haskinville	.....	.....	.....	2.39	11.4
Hemlock	48	7	32.0	2.45	9.5
Hunt	53	− 2	29.8	2.88	14.0
Ithaca	51	1	31.2	2.92	6.0
Jamestown	53	5	31.2	2.83	9.5
Jeffersonville	55	6	30.0	2.76	1.0
Keene Valley	51	−17	25.5	2.55	8.5
Lake George	50	0	28.4	2.87	6.6
Le Roy	52	7	31.4	2.11	10.8
Liberty	50	4	29.9	3.40	.....
Littlefalls, City Res.	49	0	28.5	3.76	6.5
Lockport	50	8	32.2	2.65	3.5
Lowville	45	−18	24.6	4.63	37.0
Lyndonville	.....	.....	.....	2.52	3.7
Lyons	50	5	31.2[e]	3.20	8.0
Middletown	53	10	33.4	3.18	1.0
Mohonk Lake	48	5	30.8	3.38	1.5
Moira	51	−19	22.7	2.40	.....
Mount Hope	56	14	34.0	4.20	3.0
Newark Valley	.....	.....	.....	3.37	7.0
New Lisbon	50	0	27.7	3.04	4.0
North Hammond	48[e]	−14[e]	23.6[e]	.....	0.6
North Lake	45	−27	17.9	3.89	15.0
Ogdensburg	45	−13	24.4	2.15	13.3
Oneonta	64	3	31.9	2.28	2.0
Oriskany Falls	53	− 5	29.5	3.20	12.0
Otto	59	6	33.2	1.05	1.7
Oxford	60	3	29.8	4.12	9.0
Oyster Bay	60	7	36.6	4.97	0.4
Palermo	.....	.....	.....	2.93	10.9
Perry City	49	− 4	28.7	2.25	10.9
Plattsburg	50	− 9	24.4	1.69	9.2
Port Jervis	54	9	32.1	3.49	2.0
Potsdam	50	−23	26.3	4.00	30.5
Richland	49	−11	28.4	2.60	6.0
Richmondville	53	4	30.0	3.15	1.0
Ridgeway	52	10	33.0	2.70	7.3
Ripley	54	10	32.6	0.94	1.0
Romulus	52	0	32.0	2.37	4.7
Salisbury Mills	54	5	28.0	1.60	T.
Saranac	49	− 23	23.4	3.80	34.2
Scarsdale	56	10	34.0	3.20	3.0
Setauket	59	18	36.8	4.48	T.
Shortsville	51	2	31.3	2.19	5.0
Skaneateles	.....	.....	.....	3.97	.....
Southampton	57	16	36.6	5.41	T.
South Canisteo	50	0	29.8	2.93	12.2
South Kortright	52	1	29.3	2.79	1.5
South Schroon	49	2	25.2	2.76	13.4
Spier Falls	50	0	28.1	2.65	7.0
Taberg	50	− 8	27.6	4.73	12.5
Ticonderoga	48	− 4[e]	28.2[e]	1.70	8.0
Volusia	49	7	30.1	1.81	10.0
Wappinger Falls	60	10	32.8	3.06	4.0
Warwick	.....	.....	.....	1.72	2.0
Watertown	49	−14	26.4	5.97	31.5
Waverly	55	4	31.0	3.14	3.1
Wedgwood	49	2	29.6	3.14	9.0
West Berne	58	1	30.6	0.56	2.0
Westfield	50	7	31.6	2.80	10.5
Windham	54	1	29.5	2.88	1.5
Youngstown	.....	.....	.....	2.61	6.8
North Carolina.					
Battleboro	.....	.....	.....	5.23	
Beaufort	66[f]	31	49.1[e]	8.76	
Brevard	65	10	37.3	9.71	1.5
Bryson City	.....	.....	.....	6.82	1.0
Buck Springs	52	0	30.7	4.57	8.0
Catawba	.....	.....	.....	7.66	T.
Chalybeate Springs	66	15	42.2	7.25	4.0
Chapelhill	63	18	40.4	7.81	2.0
Currituck	.....	.....	.....	6.19	
Eagletown	62	20	41.4	4.97	5.2
Edenton	67	23	44.8	5.80	1.0
Fayetteville	71	20	44.7	5.78	
Goldsboro	68	19	42.3	5.13	
Graham	.....	.....	.....	7.82	
Greensboro	63	19	40.6	6.52	
Greenville	.....	.....	.....	6.26	
Henderson	62	21	39.8	9.61	0.8
Hendersonville	53	15	37.3	8.70	2.0
Henrietta	64	16	41.4	8.56	0.4
North Carolina—Cont'd.	°	°	°	*Ins.*	*Ins.*
Horse Cove	61	18	38.4	11.43	2.2
Hot Springs	62	21	43.2	.....	.....
Jefferson	71[f]	11[f]	39.6[f]	6.33	1.1
Kinston	70	20	45.2	4.75	
Lenoir	60	13	39.4	7.95	1.5
Lexington	61	14	39.1	7.07	1.5
Lincolnton	73	14	40.4	5.55	
Linville	52	6	33.0	.....	1.0
Louisburg	61	18	41.5	5.45	2.0
Lumberton	71	20	44.0	5.19	
Manteo	68	30	47.8	6.38	
Marion	68	15	40.4	8.25	1.2
Marshall	55	17	36.3	5.21	0.5
Moncure	65	15	41.2	6.80	
Monroe	67	13	40.5	7.69	1.0
Morganton	62	11	38.8	8.89	1.0
Mountairy	63	10	38.2	6.88	3.0
Mount Holly	.....	.....	.....	7.14	
Murphy	.....	.....	.....	8.10	
Nashville	76	17	42.5	6.35	3.0
Newbern	73	25	46.4	9.27	
Patterson[i]	60	13	34.2	6.23	2.0
Pinehurst	73	20	44.2	7.70	1.0
Pink Beds	60	6	33.3	11.61	3.5
Pittsboro	68	14	44.2	6.87	4.0
Randleman	.....	.....	.....	8.18	
Reidsville	64	16	39.8	7.50	
Rockingham	69	20	43.9[d]	7.27	
Salem	62	13	38.2	6.60	2.0
Salisbury	64	14	37.8	7.66	T.
Saxon	65	10	37.1	7.48	2.6
Scotland Neck	68	21	44.8	5.29	2.0
Selma	62	18	41.6	5.90	2.0
Settle	71	13	40.5	8.29	2.0
Sloan	74	22	46.2	6.01	
Snowhill	70	15	44.1	5.68	T.
Southern Pines	68	20	43.0	7.58	5.0
Southport	67	25	48.4	11.93	
Statesville	62	11	39.0	8.09	4.0
Tarboro	69	19	43.6	5.54	2.0
Vade Mecum	63	9	36.8	8.41	2.0
Washington	69	19	46.8	4.82	T.
Waynesville	59	10	37.2	6.92	0.9
Weldon	67	19	41.6	6.13	5.0
Whiteville	.....	.....	.....	5.68	
North Dakota.					
Amenia	48	−20	16.2	T.	T.
Ashley	38	−19	15.6[d]	.....	
Berlin	39	−23	12.8	0.00	
Bottineau	36	−15	13.1	T.	T.
Buford	48	−23	17.6	0.20	2.0
Cando	37	−24	12.3	0.20	2.0
Coalharbor	40	−12	17.6	0.00	
Dickinson	46	−23	19.4	0.08	0.8
Donnybrook	43	−20	18.0	0.05	0.5
Dunseith	37	−20	14.0	0.25	2.5
Edgeley	41	−18	17.0	.....	
Edmore	40	−23	13.2	0.45	4.5
Ellendale	52	−21	19.0	0.04	0.4
Fargo	38	−18	14.8	0.05	0.5
Forman	40	−17	16.7	T.	T.
Fort Berthold	45[b]	−32[e]	18.8[g]	0.05	0.5
Fort Yates	45	−19	19.1	T.	T.
Fullerton	37	−19	14.5	T.	T.
Glenullin	38	−15	18.6	T.	T.
Grafton	36	−21	12.9	0.31	2.6
Hamilton	39	−22	11.2	1.10	10.3
Hannah	36	−24	11.8	0.10	1.0
Hillsboro	38	−15	15.0	0.15	1.5
Jamestown	42	−19	18.7	0.16	1.6
Kulm	40	−18	18.6	0.12	0.9
LaFollette	37	−18	15.4	0.20	2.0
Larimore	39	−22	13.6	0.25	2.5
Lisbon	39	−15	15.6	T.	T.
McKinney	41	−28	15.6	0.10	1.0
Manfred	37	−22	14.2	0.02	0.2
Mayville	37	−18	14.4	0.20	2.0
Medina	.....	.....	.....	0.50	5.0
Melville	38	−18	16.2[d]	0.00	
Milton	35	−25	15.0	.....	.....
Minnewaukon	39	−17	16.0[e]	0.00	
Minot	41	−26	15.7	0.00	
Moyersville	37	−22	14.5	0.05	0.5
Minto	39	−19	15.4	0.19	1.9
New England	48	−21	18.2	0.35	3.5
Napoleon	34	−21	14.0	0.00	
Oriska	38	−17	17.8	0.08	0.8
Palermo	38	−10	18.4	0.05	0.5
Park River	38	−19	14.8	0.37	3.3
Pembina	37	−20	11.4	0.57	5.7
Portal	.....	.....	.....	0.00	
Power	39	−19	15.6	0.32	3.2
Pratt	40	−34	11.7	T.	T.
Rolla	37	−17	13.8	0.41	4.1
Sentinal Butte	49	−22	22.4	0.10	1.0
Steele	36	−22	15.4	T.	T.
Wahpeton	40	−13	17.5	T.	T.
Walhalla	38	−21	14.4	1.10	11.0

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
North Dakota—Cont'd.	°	°	°	*Ins.*	*Ins.*
Willow City	40	−28	11.8	0.20	2.0
Wishek	35	−19	14.9	0.22	2.2
Ohio.					
Akron	52	13	31.2	1.27	1.2
Amesville	54	15	34.9	4.06	2.0
Atwater	.....	.....	.....	2.14	3.0
Bangorville	52	10	31.4	2.02	2.5
Bellefontaine	50	10	30.4	2.00	2.0
Benton Ridge	49	12	31.8	2.25	3.2
Bladensburg	50	10	30.8	1.84	T.
Bowling Green	51	13	31.7	3.39	10.0
Bucyrus	48	12	31.0	2.25	2.0
Cadiz	51	13	33.0	3.29	4.8
Cambridge	53	13	34.0	2.98	2.0
Camp Dennison	52	14	34.1	3.18	1.3
Canal Dover	50	13	32.2	2.72	2.5
Canton	54	14	32.3	2.03	2.7
Cardington	52	11	31.6	1.76	2.6
Clarington	51	16	35.8	3.76	5.7
Clarksville	51	17	34.2	2.60	1.2
Cleveland *a*	51	16	33.7	1.51	4.2
Cleveland *b*	51	15	32.6	1.25	4.0
Coalton	54	13	34.8	3.23	3.0
Colebrook	46	6	29.8	1.22	3.5
Dayton	52	14	33.6	2.20	0.3
Defiance	55	11	31.1	1.66	6.7
Delaware	53	13	32.4	1.92	0.8
Demos	51	13	33.4	3.56	3.5
Findlay	58	14	32.9	2.20	2.0
Frankfort	50	17	34.6	3.14	1.0
Fremont	52	15	32.8	1.72	0.2
Garrettsville	52	4	31.2	2.01	3.6
Granville	53	14	33.4	2.58	1.3
Gratiot	49	13	32.2	2.87	3.8
Green	57	16	36.2	3.23	0.5
Greenhill	51	11	30.7	2.22	2.0
Greenville	50	11	32.0	2.04	1.5
Hedges	49	7	31.3	2.25	4.0
Hillhouse	50	10	32.0	1.39	7.0
Hiram	50	10	31.6	1.74	3.5
Hudson	49	2	30.4	2.10	2.9
Ironton	58	19	37.8	4.08	T.
Jacksonburg	54	13	33.0	2.16	.....
Killbuck	50	.....	.....	2.32	0.7
Lancaster	54	17	35.0	2.66	2.5
Lima	50	14	35.0	2.45	5.5
McConnelsville	52	14	33.8	3.32	7.0
Manara	48	16	32.5	2.54	0.5
Mansfield	.....	.....	.....	2.20	1.5
Marietta	54	18	37.0	3.28	2.3
Marion	56	11	32.0	2.15	1.5
Medina	50	13	31.1	1.53	1.0
Milfordton	52	11	30.7	2.12	1.4
Milligan	51	13	33.2	3.01	2.0
Millport	49	11	31.2	2.39	3.5
Napoleon	56	14	32.6	1.67	0.7
Nellie	52	12	32.6	2.02	2.8
New Alexandria	52	13	33.2	1.75	T.
New Berlin	55	12	31.6	1.81	1.5
New Bremen	52	11	31.7	1.43	T.
New Richmond	51	15	35.0	4.00	0.2
New Waterford	49	8	31.6	2.38	2.5
North Lewisburg	50	11	32.4	2.10	1.0
North Royalton	50	14	31.4	1.35	3.5
Norwalk	52	15	33.0	1.75	1.5
Oberlin	53	14	32.2	1.63	2.5
Ohio State University	50	15	32.7	1.36	1.2
Orangeville	53	5	30.2	1.70	.....
Ottawa	49	12	32.0	1.91	0.5
Pataskala	51	14	32.9	2.56	2.1
Philo	50	14	34.2	2.20	4.7
Plattsburg	50	14	32.4	2.45	T.
Pomeroy	57	17	35.6	2.48	0.5
Portsmouth	52	18	36.4	2.78	2.0
Pulse	50	13	33.6	4.09	1.4
Rittman	52	12	32.0	1.67	0.5
Rockyridge	53	16	32.8	1.67	0.2
Shenandoah	51	12	30.4	1.51	2.3
Sidney	53	14	33.0	2.17	1.7
Somerset	48	15	34.0	2.58	7.6
South Lorain	52	11	32.6	1.35	2.4
Springfield	.....	.....	.....	1.94	0.2
Thurman	56	14	36.3	2.98	.....
Tiffin	49	15	32.6	1.85	2.0
Toledo (St. Johns College)	49	14	32.0	1.75	6.1
Upper Sandusky	51	13	32.7	1.74	1.7
Urbana	54	12	31.8	1.95	T.
Vickery	53	15	32.3	1.79	1.5
Warren	52	12	31.6	1.87	4.9
Wauseon	52	13	30.8	1.93	5.4
Waverly	54	15	34.8	3.39	3.7
Waynesville	51	14	33.2	2.25	T.
Wellington	49	14	33.2	1.21	1.0
Willoughby	.....	.....	.....	1.17	1.5
Wilson	52	14	34.2	3.46	2.0
Wooster	52	13	33.1	2.08	2.1
Zanesville	.....	.....	.....	2.91	3.5
Oklahoma.	°	°	°	*Ins.*	*Ins.*
Alva	57	18	38.8	0.05	T.
Arapaho	62	15	37.8	1.22	2.0
Blackburn	60	13	35.4	0.90	T.
Chandler	64	11	39.7	0.60	
Cloud Chief	62	17	38.0	1.40	1.0
Enid	59	17	36.1	T.	T.
Erick	59	15	38.0	1.40	.....
Fort Reno	69	9	34.7	0.02	0.2
Fort Sill	73	20	40.0	2.20	2.0
Gage	56	14	35.8	0.25	
Grand	62	11	36.4	0.62	
Guthrie	59	18	38.6	0.56	0.5
Harrington	58	14	36.6	0.88	T.
Hennessey	60	16	38.7	0.45	T.
Hobart	69	19	38.6	1.36	0.5
Jefferson	70[b]	9[b]	38.9[b]	0.30	
Jenkins	60[d]	15[d]	36.6[d]	0.40	2.0
Kenton	61	9	33.2	T.	T.
Kingfisher	60	19	37.9	0.65	T.
Luther	64[f]	16[f]	38.0[f]	0.62	T.
Meeker	65	16	36.9	0.30	
Newkirk	58	18	37.3	0.37	T.
Norman	59	18	37.8	0.96	1.0
Okeene	.....	.....	.....	0.42	T.
Perry	58	15	37.5	0.88	
Sac and Fox Agency	59	18	39.0	.....	
Shawnee	58	18	38.9	1.05	
Stillwater	58	16	36.4	0.62	
Taloga	58[e]	11	31.2[d]	0.50	1.0
Temple	61	20	39.1	2.23	
Watonga	60	12	36.2	0.53	0.8
Waukomis	60	19	39.2	0.45	
Whiteagle	58	16	37.0	0.64	.....
Woodward	.....	.....	.....	0.03	
Oregon.					
Alba	.....	.....	.....	1.98	
Albany	.....	.....	.....	4.74	
Alpha	58	24	40.6	11.54	
Arlington	56	24	36.1	1.08	
Ashland	61	21	39.4	2.07	9.8
Astoria	51	30	42.1	12.15	
Aurora (near)	53	26	39.0	4.94	
Bay City	56	26	43.0	15.11	
Bend	52	4	31.6	.....	12.9
Beulah	50	2	23.9	0.50	5.0
Blackbutte	53	26	36.6	6.10	1.0
Blalock	52	35	39.4	1.03	T.
Bullrun	.....	.....	.....	9.56	2.0
Burns	42	−10	18.0	0.57	8.9
Carlton	53	25	38.2	5.78	
Cascade Locks	49	25	36.3	12.19	
Corvallis	56	26	39.7	6.16	
Dale	.....	.....	.....	1.60	3.0
Dayville	55	15	36.6	0.94	T.
Doraville	49	23	36.4	6.21	2.0
Drain	58	28	41.8	6.88	
Echo	54	21	35.1	0.71	T.
Ella	50	21	33.6	0.70	.....
Eugene	56	26	40.6	4.88	
Fairview	60	25	44.4	8.88	T.
Falls City	58	24	38.6	13.38	
Forestgrove	53	22	37.6	7.08	
Gardiner	59	31	43.8	9.27	
Glendale	54	21	38.2	2.65	3.0
Glenora	51	23	37.6	24.48	25.0
Gold Beach	57	29	44.6	10.98	
Government Camp	61	5	32.4	10.45	62.0
Granite	.....	.....	.....	1.78	.....
Grants Pass	56	17	37.7	3.87	1.0
Grass Valley	48	19	33.1	1.35	
Heisler	57	11	36.6	0.45	T.
Heppner	59	21	36.2	1.10	T.
Hood River	49	22	35.4	4.81	3.0
Huntington	43	3	24.4	1.63	16.5
Jacksonville	61	22	37.2	2.68	0.8
John Day	56	10	32.5	0.70	3.0
Joseph	41	5	23.0	0.87	8.7
Kerby	55	17	38.0	8.02	1.5
Klamath Falls	50	0	29.4	1.18	0.3
Lagrande	48	8	31.8	2.02	15.0
Lakeview	48	−8	25.0	1.08	.....
Lonerock	60	13	33.2	0.20	2.0
McKenzie Bridge	53	18	36.8	8.15	9.0
McMinnville	60	24[f]	39.8[c]	6.40	
Marshfield	56	27	43.5	7.94	
Meacham	.....	.....	.....	4.72	34.8
Mill City	56	23	37.8	5.85	0.4
Monroe	58	27	40.8	7.33	
Mount Angel	57	21	39.8	5.26	0.5
Nehalem	.....	.....	.....	14.78	
Newport	55	31	45.4	9.61	
Odell	.....	.....	.....	0.88	8.8
Ontario	.....	.....	.....	0.59	11.2
Paisley	47	9	30.6	.....	.....
Pendleton	51	21	34.7	1.52	0.5
Port Oxford	64	35	47.4	9.31	
Prineville	54	8	34.4	0.47	.....
Riverside	49	−8	21.4	.....	
Oregon—Cont'd.	°	°	°	*Ins.*	*Ins.*
Salem	55	27	40.4	4.58	
Silverlake	50	−1	27.2[c]	0.07	2.5
Sparta	42	8	25.2	3.90	39.0
Stafford	53	25	43.3	6.73	T.
The Dalles	50	23	36.2	1.07	0.5
Toledo	59	28	43.8	12.71	T
Umatilla	55	23	35.0	0.79	
Van	.....	.....	.....	1.60	10.0
Vancycle	48	12	31.8	1.82	5.0
Wallowa	43	−4	22.8	1.14	14.7
Wamic	53	19	34.3	0.85	1.0
Warm Spring	57	12	35.8	0.68	T.
Weston	51	15	31.0	2.99	15.7
Pennsylvania.					
Aleppo	55	13	34.2	3.93	5.0
Altoona	52	8	31.5	3.36	T.
Beaver Dam	.....	.....	.....	3.31	.....
Bellefonte	55	11	35.0	3.60	1.0
Brookville	.....	.....	.....	4.76	1.8
Browers	.....	.....	.....	3.10	.....
California	55	16	36.2	3.70	1.6
Cassandra	50	5	30.4	3.61	4.0
Centerhall	50	8	31.3	4.21	1.8
Clarion	.....	.....	.....	4.22	2.1
Claysville	55	12	34.0	3.19	4.0
Coatsville	58	15	36.2	3.79	2.5
Confluence	.....	.....	.....	3.65	3.0
Davis Island Dam	.....	.....	.....	3.09	0.6
Derry	55	9	34.1	4.27	1.0
Doylestown	.....	.....	.....	3.46	.....
Dushore	55	5	30.8	2.95	0.2
East Mauch Chunk	57	11	34.2	3.81	.....
Easton	56	15	34.6	2.71	0.1
Ellwood Junction	.....	.....	.....	3.32	1.4
Emporium	50	5	32.0	5.40	1.4
Ephrata	55	11	34.7	3.20	1.0
Everett	55	6	32.2	3.09	2.3
Forks of Neshaminy	.....	.....	.....	3.33	.....
Franklin	53	2	30.9	3.28	2.0
Freeport	52	11	33.8	4.21	0.8
Gettysburg	57	6	34.8	4.45	5.5
Girardville	.....	.....	.....	4.99	T.
Gordon	54	7	31.8	4.67	T.
Greensboro	.....	.....	.....	4.29	1.0
Greenville	51	8	31.3	2.37	8.8
Hamburg	54	15	34.9	4.02	.....
Hanover	63	15	37.4	3.75	5.2
Herrs Island Dam	.....	.....	.....	3.40	0.5
Huntingdon	57	8	33.7	4.02	2.0
Indiana	54	5	31.4	3.84	0.6
Irwin	59	11	35.8	4.53	2.0
Johnstown	56	13	34.5	4.42	T.
Keating	.....	.....	.....	4.19	T.
Lansdale	.....	.....	.....	2.65	.....
Lawrenceville	55	2	31.2	3.97	3.5
Lebanon	56	15	35.4	3.23	0.1
Leroy	50	4	30.8	3.36	3.0
Lewisburg	53	12	33.8	3.97	0.2
Lockhaven	53	10	33.8	3.38	T.
Lock No. 4	.....	.....	.....	3.67	0.5
Lycippus	55	12	34.1	3.53	3.2
Marion	53	5	33.4	4.02	6.0
Mifflintown	53	8	33.4	3.62	1.0
Milford	52	7	31.3	4.29	1.0
Montrose	52	4	30.6	2.39	0.9
New Germantown	59	9	34.8	4.40	0.8
Ottsville	.....	.....	.....	2.19	.....
Parker	.....	.....	.....	3.84	4.6
Philadelphia	60	20	39.8	4.21	2.6
Pocono Lake	50	5	29.4	3.47	T.
Point Pleasant	.....	.....	.....	3.13	.....
Pottsville	.....	.....	.....	4.03	.....
Reading	55	16	35.8	2.65	0.3
Renovo	.....	.....	.....	4.07	T.
Saegerstown	51	−5	30.9	2.35	7.5
St. Marys	48	4	28.8	4.67	8.0
Saltsburg	.....	.....	.....	3.24	1.2
Seisholtzville	.....	.....	.....	3.08	.....
Selinsgrove	54	12	34.1	3.69	T.
Shawmont	.....	.....	.....	3.34	.....
Skidmore [4]	53	4	31.4	.....	.....
Smiths Corners	.....	.....	.....	3.33	.....
Somerset	50	5	30.2	4.51	3.7
South Eaton	54	10	33.0	2.83	T.
Springdale	.....	.....	.....	3.84	1.1
Springmount	.....	.....	.....	2.61	.....
State College	51	9	32.2	3.40	1.2
Swarthmore	57	14	37.1	4.31	3.0
Towanda	54	8	31.8	2.56	1.5
Uniontown	59	15	37.0	5.48	4.5
Warren	55	2	30.1	3.88	6.9
Westchester	59	15	37.0	3.37	3.5
West Newton	.....	.....	.....	4.02	1.0
Wilkesbarre	52	10	34.0	3.18	.....
Williamsport	51	13	34.5	3.77	
Rhode Island.					
Bristol	58	13	35.2	3.82	2.0
Kingston	58	9	33.2	5.56	3.0

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Rhode Island—Cont'd.	°	°	°	*Ins.*	*Ins.*
Narragansett	58	11	35.0	3.94	1.5
Pawtucket	61	19	39.1	5.41	2.0
Providence	59	12	35.2	5.38	4.0
South Carolina.					
Aiken	69	24	44.6	8.10	
Allendale	73	28	50.6	7.49	
Anderson	66	20	42.8	7.93	
Barksdale[f]	58	22	38.2	.....	0.1
Batesburg	70	22	43.2	6.92	
Beaufort	71	28	49.6	5.77	
Bennettsville	70	22	44.8	6.44	
Blackville	72	25	45.4	7.38	
Blair	.....	.....	.....	7.30	
Bowman	74	24	45.4	7.15	
Calhoun Falls	.....	.....	.....	5.45	
Camden	.....	.....	.....	7.78	
Chappells	.....	.....	.....	11.18	
Cheraw	71	21	42.6	7.52	
Clarks Hill	73	22	45.2	9.82	T.
Clemson College	69	19	44.4	10.09	
Conway	74	25	46.6	5.13	
Dillon	71	23	44.2	6.27	
Due West	65	24	44.3	8.87	T.
Edisto	.....	.....	.....	6.40	
Effingham	.....	.....	.....	5.15	
Enoree	.....	.....	.....	9.00	
Florence	69	25	44.8	4.02	
Gaffney	70	17	42.9	5.96	T.
Georgetown	71	26	49.4	8.90	
Greenville	65	16	38.0	8.85	T.
Greenwood	64	22	41.0	9.27	
Heath Springs	64	23	42.1	7.83	
Liberty	63	18	41.8	9.49	T.
Little Mountain	68	21	42.8	7.15	T.
Newberry	68	21	42.4	9.04	0.2
Pelzer	.....	.....	.....	8.97	T.
Pinopolis[g]	70	28	46.4	5.29	
St. George	72	22	45.6	3.20	
St. Matthews	68	26	45.0	7.56	
St. Stephens	.....	.....	.....	5.24	
Saluda	66	20	43.8	7.71	
Santuck	66	19	41.8	9.93	0.5
Seivern	70	17	43.0	7.65	
Smiths Mills	.....	.....	.....	6.22	
Society Hill	68	23	41.5	7.52	
Spartanburg	62	20	39.8	8.07	T.
Statesburg	69	24	45.8	7.50	
Summerville	75	25	48.3	6.00	
Sumter	71	23	46.2	7.06	
Trenton	68	23	44.6	8.63	
Trial	75	26	46.7	4.60	
Walhalla	64	17	42.0	9.78	T.
Walterboro	77	25	48.0	4.76	
Winnsboro	58	20	42.2	7.05	T.
Winthrop College	64	21	41.9	8.35	0.8
Yemassee	74	26	45.4	5.43	
Yorkville	64	23	43.7	8.87	2.0
South Dakota.					
Aberdeen	40	—18	16.0	0.63	1.0
Academy	55	— 6	29.2	0.02	0.2
Alexandria	55	— 9	26.2	T.	T.
Armour	58	—26	27.5	0.02	0.2
Ashcroft	54	—12	26.0	T.	T.
Bowdle	40	—20	18.2	T.	T.
Brookings	48	— 9	22.6	T.	T.
Canton	53	— 6	27.0	T.	T.
Castlewood	43	—10	21.4	0.03	0.3
Centerville	54	— 5	26.8	0.06	0.6
Chamberlain	59	— 9	27.9	0.01	0.2
Clark	38	—15	18.8	0.45	4.5
Dallas	67	—12	29.6	T.	T.
Desmet	44	—14	21.2	0.12	1.2
Doland	42	—15	19.7	0.25	2.5
Elkpoint	55	— 5	29.2	0.02	0.2
Fairfax	60	— 6	31.6	T.	T.
Farmingdale	.....	.....	.....	T.	T.
Faulkton	49	—15	17.9	0.05	0.5
Flandreau	48	— 7	23.9	0.20	2.0
Forestburg	52	—12	22.9	T.	T.
Fort Meade	65	— 6	31.8	0.12	1.2
Gannvalley	53	—10	24.9	0.00	
Grand River School	46	—21	18.8	0.10	0.5
Greenwood	60	— 4	31.5	0.03	0.3
Highmore	44	—14	22.4	T.	T.
Hotch City	58	—16	25.3	0.00	
Howell	42	—17	18.1	0.04	0.4
Howard	55[e]	4[e]	26.1[e]	0.04	0.4
Ipswich	38	—17	16.0	T.	T.
Kidder	40	—22	14.3	T.	T.
Kimball	54	—10	26.2	0.00	
Leola	37	—16	16.8	0.00	
Marion	52	— 9	25.8[f]	0.00	
Mellette	41	—21	17.7[f]	0.00	
Menno	57	— 7	28.0	T.	T.
Mil'bank	50	—17	20.7	T.	T.
Mitchell	57	—11	26.6	T.	T.
Mound City	40	—20	15.2	0.10	1.0
Oelrichs	48	—11	22.7	0.30	3.0
South Dakota—Cont'd.	°	°	°	*Ins.*	*Ins.*
Ramsey	51	—10	23.4	0.10	1.0
Redfield	43	—20	16.2	0.04	1.0
Rosebud Agency	56	—10	29.8	T.	T.
Sioux Falls	51	— 6	26.2	T.	T.
Spearfish	62	5	32.1	T.	T.
Stephan	48	—12	23.0	T.	T.
Tyndall	57	— 6	30.2	T.	T.
Vermillion	54	— 5	28.4	0.01	0.1
Watertown	43	—12	20.0	T.	T.
Wentworth	49	— 9	24.2	0.06	0.6
Whitehorse	44	—22	18.6	T.	T.
Woolsey	.....	.....	.....	0.93	4.0
Tennessee.					
Andersonville	60	16	35.9	5.15	0.5
Ashwood	62	12	39.6	5.15	2.0
Benton	63	15	40.5	7.21	T.
Bluff City	.....	.....	.....	4.58	1.0
Bolivar	57[a]	18[d]	38.0[d]	4.50	T.
Bristol	60	15	37.4	3.37	2.0
Brownsville	63	21	38.9	2.90	
Byrdstown	63	16	42.4	5.45	1.1
Carthage	59	19	40.9	5.07	
Catlettsburg	.....	.....	.....	3.37	0.5
Cedar Hill	57	18	38.6	3.65	T.
Celina	.....	.....	.....	5.10	
Charleston	.....	.....	.....	7.22	T.
Clarksville	56	19	38.6	3.58	0.3
Clinton	.....	.....	.....	4.80	T.
Covington	57	20	38.6	5.35	
Dandridge	.....	.....	.....	5.06	3.0
Decatur	62	15	39.9	7.47	0.5
Dickson	57	13	38.2	4.32	T.
Dyersburg	56	20	38.3	4.75	
Elizabethton	62	14	39.2	3.12	0.7
Erasmus	59	10	36.6	6.43	1.5
Florence	60	18	39.3	5.12	1.0
Franklin	56	18	38.4	4.23	0.2
Greeneville	59	15	39.4	4.95	3.5
Halls Hill	.....	.....	.....	5.49	2.5
Harriman	59	18	41.1	5.94	
Hohenwald	59	9	35.6	5.77	2.5
Iron City	67	14	38.8	4.53	1.5
Isabella	63	16	40.2	9.18	1.0
Jackson	59	19	40.4	3.90	
Johnsonville	57	15	39.1	3.68	T.
Jonesboro	60	13	39.2	4.65	2.0
Kenton	56	19	38.5	4.48	T.
Kingston	.....	.....	.....	6.05	T.
Lafayette	59	14	38.7	3.81	0.5
Leadvale	.....	.....	.....	4.51	2.0
Lewisburg	65	16	39.7	6.04	3.2
Loudon	.....	.....	.....	5.05	T.
Lynnville	61	18	38.8	6.10	1.5
McGee	.....	.....	.....	6.35	2.0
McMinnville	63	15	40.0	5.22	2.3
Maryville	61	16	40.5	6.06	1.5
Milan	55	19	37.9	4.43	T.
Newport	62	14	39.8	5.40	2.0
Palmetto	64	14	39.2	5.74	1.0
Pope	58	14	40.0	5.59	T.
Rogersville	60	14	38.8	4.42	2.3
Rugby	60	9	37.3	5.87	3.5
Savannah	60	16	39.4	5.23	0.2
Sewanee	57	16	37.3	5.29	4.0
Silver Lake	52	12	34.4	4.60	4.8
Sparta	63	18	40.7	.....	.....
Springdale	61	12	39.3	4.01	1.5
Springville	62	16	38.6	4.60	T.
Tazewell	.....	.....	.....	4.69	2.0
Tellico Plains	61	14	40.4	7.01	T.
Tracy City	58	13	37.4	6.94	2.0
Trenton	57	19	39.0	3.82	T.
Union City	57	18	37.6	4.17	T.
Walling	.....	.....	.....	4.95	1.0
Waynesboro	62	14	38.6	5.68	2.0
Wildersville	55	18	38.9	4.49	
Yukon	66	18	41.4	5.03	2.0
Texas.					
Alvin	.....	.....	.....	5.81	
Arthur	.....	.....	.....	6.00	.....
Austin	67	30	47.2	2.40	
Ballinger	62	18	41.5	0.77	
Beaumont	80	23	49.0	4.12	
Beeville	78	28	50.9	2.21	
Big Spring	75	12	42.9	0.77	T.
Blanco	60	20	46.7	1.79	
Boerne	70	18	44.6	1.80	
Bonham	62	25	41.2	6.43	
Booth	.....	.....	.....	3.95	
Bowie	62	22	40.0	1.91	T.
Brazoria	74	32	53.7	4.43	
Brenham	69	31	47.2	4.69	
Brighton	72[e]	30[b]	53.1[b]	2.31	
Brownwood	65	21	41.7	1.38	
Channing	59	12	35.3	0.60	.....
Childress	67	18	39.0	1.25	.....
Clarksville	58	24	39.6	7.80	1.0
Claude	60	8	33.0	0.09	3.0
Texas—Cont'd.	°	°	°	*Ins.*	*Ins.*
College	72	31	47.7	4.09	
Coleman	67	23	45.6	1.10	
Colorado	66	13	41.0	0.57	
Columbia	73	27	50.6	5.10	
Columbus	.....	.....	.....	3.40	
Corsicana	69	28	48.6	4.77	T.
Crockett	67	27	46.2	6.07	
Cuero	78	27	48.6	3.78	
Dalhart	.....	.....	.....	0.06	1.0
Dallas	68	25	41.3	6.52	T.
Danevang	74	29	51.0	5.60	
Del Rio	72	21	46.4	1.35	
Dialville	60	28	43.1	6.95	0.5
Duval	67	25	46.4	3.01	
Eagle Pass	70	23	46.0	1.65	
Fort Brown	76	33	56.6	3.85	
Fort Clark	73	25	47.4	1.75	
Fort Davis	64	14	37.9	1.77	2.0
Fort McIntosh	72	22	48.2	1.89	
Fort Stockton	71	19	42.7	1.19	
Fredericksburg	67	20	42.8	2.21	
Gainesville	59[i]	21[b]	39.0[i]	3.90	
Georgetown	68	23	45.4	3.16	
Gonzales	.....	.....	.....	2.49	
Graham	68	19	41.5	1.20	
Grapevine	.....	.....	.....	4.79	0.2
Greenville	60	27	40.8	7.46	
Hale Center	55	8	35.2	0.92	2.0
Hallettsville	72[e]	31[e]	50.0[e]	3.23	
Haskell	72	18	41.7	1.08	
Hearne	68	25	44.7	4.90	
Hempstead	.....	.....	.....	4.66	
Henrietta	61	22	39.9	1.90	
Hewitt	.....	.....	.....	5.24	T.
Hillsboro	66	24	42.2	4.90	.....
Hondo	70	25	48.8	1.58	
Huntsville	64	23	42.8	4.72	
Jefferson	58	23	41.7	10.53	2.0
Jewett	65	23	43.2	5.51	
Junction	.....	.....	.....	2.34	
Kaufman	63	22	42.8	6.21	.....
Kent	67	18	42.3	1.20	3.0
Kerrville	62	21	43.9	3.38	
Knickerbocker	68	11	42.4	0.19	
Kopperl	.....	.....	.....	4.80	
Lampasas	68	20	42.6	3.93	
La Para	.....	.....	.....	2.01	
Laureles Ranch	.....	.....	.....	1.88	
Liberty	75	25	50.2	5.10	
Llano	67	20	41.8	0.23	
Longlake	.....	.....	.....	5.85	
Longview	58	26	40.8	8.96	1.3
Luling	71	26	47.4	3.03	
Mann	67[e]	24	43.2[b]	6.05	T.
Marlin	69	26	43.6	6.24	
Memphis	66	21	39.6	0.40	
Menardville	.....	.....	.....	1.88	
Mexia	64	28	41.9	6.36	
Miami	58	17	36.0	0.59	0.2
Mount Blanco	65	11	36.3	0.62	T.
Mount Pleasant	61	24	41.6	8.32	4.0
Nacogdoches	62	23	41.8	5.86	T.
New Braunfels	71	25	47.5	2.39	
Panter	.....	.....	.....	4.02	3.8
Paris	60	26	41.0	6.64	.....
Port Lavaca	79	32	51.8	5.37	
Quanah	64	20	41.6[e]	1.35	T.
Rhineland	67	15	41.7	1.85	
Riverside	.....	.....	.....	5.26	
Rock Island	72	28	48.8	3.91	
Rockland	.....	.....	.....	5.45	
Runge	.....	.....	.....	3.36	
Sabinal	79	28	47.4	1.36	
San Marcos	70	23	46.4	2.18	
San Saba	67	18	42.2	1.96	
Santa Gertrude	.....	.....	.....	1.60	
Seymour	63	19	39.4	1.51	
Sherman	65	25	41.0	4.45	T.
Sonora	68	14	42.1	1.61	
Sugarland	73	26	49.6	4.79	
Sulphur Springs	59	26	41.6	8.31	1.0
Temple	6	24	43.0	4.91	
Texline	59	7	35.8	0.00	
Trinity	68	22	46.0	5.76	
Tyler	58	27	40.9	8.12	T.
Uvalde	.....	.....	.....	1.25	
Valley Junction	.....	.....	.....	4.81	
Victoria	72	28	51.2	3.33	
Waco	.....	.....	.....	5.61	
Waxahachie	65	23	41.3	5.51	T.
Weatherford	59	25	40.3	2.64	.....
Willspoint	62	24	41.6	7.50	T.
Utah.					
Alpine	.....	.....	.....	1.90	19.0
Alta	.....	.....	.....	2.08	49.9
Aneth	50	2	28.0	0.20	2.0
Beaver	61	— 3	27.6	0.20	.....
Blacksmith Fork	.....	.....	.....	1.25	12.5

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Utah—Cont'd.	°	°	°	*Ins.*	*Ins.*
Castledale	51	— 9	20.2	0.25	2.5
Castle Rock				0.25	5.5
Clear Creek				1.00	10.0
Corinne	48	— 4	22.2	1.00	10.0
Coyoto	39	—19	14.6	0.01	0.1
Deseret	50	— 9	21.0	0.13	4.0
Experiment Farm	61	12	35.8		
Farmington	46	1	26.8	1.67	16.7
Fillmore	54	— 1	27.3	0.54	
Fort Duchesne	34	—11	12.1	0.20	2.0
Frisco	57	3	29.8	0.30	
Garrison	55	0	23.6	0.11	
Giles	48	3	27.8	0.12	1.8
Government Creek	48	— 2	21.0	0.63	7.5
Grayson	50	4	26.3	0.25	2.5
Heber	45	—14	17.0	0.80	15.0
Henefer	50	—20	16.3	1.16	12.0
Hite	56	14	34.3	T.	1.0
Huntsville				0.96	12.0
Ibapah	43	—22	15.7	0.75	7.5
Indianola				0.73	
Kanab	54[1]	1[1]	25.5[1]	0.50	5.0
Kelton				0.20	2.0
La Sal	50	— 2	21.8	0.39	3.9
Levan	44	— 5	19.0	0.94	9.6
Loa	35	—21	7.8		
Logan	45	— 1	19.3	0.30	
Lucin	43	— 8	23.0	0.20	2.0
Manti	48	— 3	20.8	1.10	11.0
Marion				0.67	9.8
Marysvale	51	—13	20.8	0.16	2.6
Meadowville	40	— 4	19.4	0.40	4.0
Millville				0.34	
Moab	48	6	27.8	0.11	1.0
Morgan	57	—18	15.8	1.02	11.9
Mount Nebo	49	— 5	21.4	0.32	6.0
Mount Pleasant	54	— 6	22.6	1.10	11.0
Nephi				0.69	8.8
Oak City	52	— 3	23.1	0.54	4.0
Ogden	45	4	24.2	1.35	14.5
Panquitch				T.	T.
Parowan	56	— 2	25.2	0.32	3.4
Payson				2.30	23.0
Pinto	55	— 8	22.6		
Plateau	47	—28	17.0	0.91	10.6
Provo	51	—10	21.9	1.80	18.0
Ranch	53	— 5	22.4	0.26	
Randolph				T.	T.
Richfield	54[1]	— 1[1]	24.0[1]	0.28	2.8
Rockville	63	13	37.8	0.41	
St. George	61	12	37.1	0.37	3.8
Salt Air	40	3	25.8	0.67	11.2
Scipio	55	—16	19.1	0.50	5.0
Snowville	50	— 9	20.6	0.60	6.0
Soldier Summit	30	—13	13.8	0.37	7.0
Sunnyside				0.40	4.0
Thistle	48	—13	19.2	1.50	15.0
Tooele	44	5	25.7	0.71	
Tropic	45	3	25.0	0.40	4.0
Trout Creek	50	— 5	24.0	0.23	3.0
Utah Lake	49	—15	19.0	1.21	14.0
Vernal	30	— 6	12.2	0.21	3.3
Wellington	51	— 7	23.0		
Vermont.					
Burlington	45	— 3	28.3	1.51	12.5
Cavendish	49	— 8	26.1[c]	2.36	
Cornwall	45	— 7	27.3	2.06	12.0
Enosburg Falls	47	—28	21.4	3.04	19.0
Jacksonville	52	—10	26.3	3.93	11.0
Manchester	59	— 2	27.6	3.65	5.8
Norwich	45	—13	23.3	2.74	9.0
St. Johnsbury	45	—19	22.6	2.92	12.5
Wells	52	— 5	25.0	2.44	6.5
Westfield	63	—24	25.9	3.98	18.9
Woodstock	54	—16	24.2	2.68	24.0
Virginia.					
Alexandria	57	16	37.3		
Arvonia	60	9	36.4	6.08	1.5
Ashland	60	18	37.4		0.5
Barboursville	62	17	38.8	6.39	2.0
Bigstone Gap	57	9	38.4	4.00	1.5
Blacksburg	58	10	34.9	3.76	4.7
Buchanan				6.21	0.2
Burkes Garden	50	12	31.8	3.58	2.0
Callaville	64	16	41.4	6.17	0.5
Cape Henry	68	27	43.8	3.57	0.2
Charlottesville	62	15	38.8	3.27	0.8
Clarksville				6.57	
Columbia	61	14	37.6	6.25	1.5
Dale Enterprise	59	8	34.6	3.88	6.0
Danville				6.72	
Dinwiddie	64	11	39.2	8.24	0.5
Farmville	60	16	36.0		
Fredericksburg	60	16	37.6	5.75	2.1
Grahams Forge	58	7	34.7	5.13	1.8
Hampton	68	25	42.8	4.61	
Hot Springs	54	15	33.0	4.69	2.5
Ivanhoe				5.43	
Virginia—Cont'd.					
Lexington	65	13	36.2	3.27	2.8
Lincoln	61	3	34.6	4.44	8.0
Marion	55	14	35.6	3.21	2.0
Mendota				3.84	2.0
Newport News	65	24	43.2	4.36	1.5
Nokesville (near)	60	14	36.6		
Petersburg	68	11	38.7	7.23	1.0
Quantico	60	13	37.6	6.35	1.8
Radford				2.62	10.0
Randolph				6.50	
Riverton				3.77	9.0
Roanoke	63			3.71	4.5
Rockymount	61	13	37.8	7.51	3.0
Saxe	64	12	38.8	5.58	
Shenandoah				3.61	6.7
Speers Ferry				5.68	3.0
Spottsville	66	16	42.0	4.13	1.0
Staunton	59	13	37.1	3.93	2.0
Stephens City	61	8	35.4	4.22	1.1
Warsaw	60	15	39.0	5.68	1.0
Williamsburg	67	18	40.8	5.60	0.3
Woodstock	61	10	35.8	3.74	11.5
Washington.					
Aberdeen	54	25	40.6	14.69	6.0
Anacortes	57	31	42.4	2.36	
Ashford				9.21	21.0
Bellingham	58	27	41.4	2.60	
Blaine	51	29	40.6	3.33	T.
Brinnon	50	28	39.6	12.70	
Cedonia	37	7	25.5	2.06	20.9
Centralia	55	26	39.6	6.98	0.5
Cheney	47	0	28.4	1.35	15.0
Clearbrook	57	28	36.0	4.20	
Clearwater	51	28	40.0	20.11	T.
Cle Elum	46	5	28.5	3.57	23.0
Colfax	48	12	34.4	1.19	3.5
Colville	44	11	28.8	2.01	12.0
Conconully	44	4	26.0	0.99	6.8
Coupeville	60	30	43.0	1.89	
Crescent	38	10	27.2	2.10	16.0
Cusick	38	— 4	24.6	1.79	13.8
Danville	41	4	26.6	0.95	6.2
Dayton	51	20	34.8	1.50	9.0
Easton				4.95	48.0
East Sound	53	26	40.0	3.21	T.
Ellensburg	47	11	28.5	0.77	4.5
Ephrata	45	13	27.9	1.20	11.0
Fort Simcoe				1.15	2.5
Grandmound	56	23	38.7	6.63	2.0
Granite Falls				7.39	
Hatton	45	13	30.7	1.13	T.
Horse Heaven				0.90	
Ilwaco	56	29	43.3	13.98	
Kennewick	51	17	33.3		
Kiona	50	11	34.4	0.79	
Kosmos	52	26	38.4	7.66	2.5
Lacenter	52	21	37.0	8.63	0.5
Lakeside	46	16	30.0	1.38	12.5
Lester	51	17	36.0	6.75	
Lind	40	5	27.1	1.46	9.0
Loomis	41	14	28.5	0.70	6.0
Merritt				8.64	57.0
Mottinger Ranch	54	23	34.6	1.30	
Mount Pleasant	53	24	39.4	7.45	T.
Moxee	46	12	31.4	0.55	1.3
Northport	40	13	27.4	1.33	13.3
Odessa	46	7	29.4	1.39	7.0
Olga	52	33	42.1	3.12	
Olympia	53	24	40.2	8.88	T.
Pinehill	52	21	34.7	3.10	2.6
Pomeroy	55	20	35.6	1.65	3.5
Port Townsend	53	32	42.0	2.16	
Pullman	43	15	32.8	1.46	8.2
Rattlesnake	48	13	29.2	1.12	3.2
Republic	38	1	23.6	0.93	10.0
Rock Lake				1.21	4.0
Rosalia	43	14	31.6	1.88	10.0
Sedro	51	30	40.8	6.35	
Snohomish	53	30	40.8	5.54	T.
Snoqualmie	54	20	40.0		
Southbend	58	30	42.2	15.03	
Sunnyside	50	15	31.5	0.37	
Tekoa				1.35	4.0
Touchet	54	18	34.4	0.69	T.
Twisp	40	0	23.0	1.23	15.0
Union	55	26	39.4	13.97	0.5
Vancouver	54	24	38.8	5.47	
Vashon	51	32	41.5	6.96	T.
Wahluke	52	11	32.8	0.60	1.0
Waterville	38	6	23.8	1.30	11.2
Wenatchee (near)	41	8	26.2	1.35	17.5
Wilbur	46	1	25.1	1.40	5.3
Zindel	53	24	37.4	0.59	T.
West Virginia.					
Bancroft	60	18	37.8	3.22	T.
Bayard	54	3	30.8	2.94	10.0
Beckley	61	11	35.0	2.10	3.5
Bens Run	52	16	35.1	3.64	5.0
West Virginia—Cont'd.					
Berkley Springs	59	10	35.2		
Bluefield	51	19	35.8		
Buckhannon	57	14	34.7	3.45	1.8
Burlington	59	8	34.8	3.75	8.0
Cairo	55	14	36.2	5.24	2.5
Central	57	12	35.1	3.51	2.3
Charleston	70	20	42.4	2.96	0.1
Creston	55	11	35.6	1.30	1.0
Cuba	59	15	36.4	3.26	T
Elkhorn	58	18	37.6		
Fairmont	57	14	35.4	3.90	2.0
Glenville	57	14	36.6	3.08	2.5
Grafton	57	12	36.2	3.15	2.8
Green Sulphur Springs	65	12	35.5	2.62	1.0
Harpers Ferry				3.76	8.5
Hinton	56	16	37.8	2.89	2.0
Huntington	54	17	35.6	3.68	T.
Lewisburg	56	11	35.2	3.18	3.9
Logan	70	17	41.0	4.18	1.0
Lost Creek	55	15	35.1	3.36	2.0
Madison	60[f]	15[f]	34.8[f]	2.66	T.
Martinsburg	55	10	34.5	2.98	7.3
Moorefield	65	6	36.0	1.87	1.4
Morgantown	60	12	36.0	3.85	1.0
Moundsville	53	15	35.8	3.74	2.0
New Cumberland	50	12	33.2	2.10	2.0
New Martinsville	57	14	37.4	3.92	3.0
Oceana	58	14	37.0	3.40	2.0
Parsons	55	8	33.6	1.57	6.5
Philippi	57	11	35.8	3.31	4.4
Pickens	52	10	32.3	3.38	11.0
Point Pleasant	57	19	37.9	3.71	1.0
Powellton	58	16	37.8	1.35	4.5
Princeton				4.50	5.6
Romney				1.93	7.0
Rowlesburg				3.14	3.1
Ryan	57	15	36.2	3.47	2.0
Smithfield	54	13	33.4	3.88	5.5
Southside	57	15	36.2	3.53	2.7
Sutton	62	13	36.4	3.76	1.5
Terra Alta	60	15	33.0	1.83	7.0
Union	62	12	36.0	3.08	4.0
Uppertract	61	7	35.1	4.25	13.6
Valley Fork	57	13	36.2	2.77	0.5
Wellsburg	58	13	33.0	3.17	5.5
Weston				3.60	5.3
Wisconsin.					
Amherst	44	— 3	23.5	1.60	16.2
Antigo	45	— 5	23.0	0.80	8.0
Appleton	56	— 1	26.8	1.18	5.8
Appleton Marsh	47	— 6	23.4	1.26	12.5
Ashland	42	— 7	23.4	0.11	T.
Barron	52	—12	21.9	T.	T.
Beloit	48	7	27.8	1.48	3.0
Berlin	48	— 3	24.0	0.18	1.8
Black River Falls				1.08	12.0
Burnett	50	7	25.4	0.98	5.5
Chilton	48	— 2	26.2	1.30	7.8
Chippewa Falls				0.38	6.0
Downing	44	—12	20.4	0.50	5.0
Eau Claire	42	— 3	22.2	0.31	3.1
Florence	45	— 9	21.5	1.78	12.5
Fond du Lac	48	— 6	25.0	0.60	3.0
Grand Rapids	45	— 7	23.7	1.20	13.5
Grand River Locks				1.81	13.0
Grantsburg	42	—24	16.2	T.	T.
Hancock	45	— 6	24.0	1.59	15.0
Harvey	49	— 4	26.4	1.67	5.9
Hayward	47	—20	18.3	0.30	3.0
Hillsboro	51	—18	23.7	1.60	16.0
Koepenick	48	—12	21.4	1.40	14.0
Lancaster	50	— 5	25.0	0.40	4.0
Manitowoc	47	3	28.0	1.37	5.7
Mauston	54	— 2	26.5	1.14	10.5
Meadow Valley	48	—12	23.4	0.94	11.0
Medford	51	— 5	22.6	0.50	5.0
Menasha				0.59	4.2
Merrill	43	— 8	21.2	0.99	19.5
Minocqua	45	— 7	19.7	1.05	10.5
Mount Horeb	50	— 9	25.4	1.37	11.5
Neillsville	42	—10	21.8	1.60	16.0
New London	45	— 4	25.2	1.49	10.0
New Richmond	45	— 8	22.2	0.41	4.0
Oconto	46	1	26.5	1.02	6.5
Osceola	43	—15	18.6	0.20	2.0
Oshkosh	47	— 3	26.0	1.00	1.0
Pine River	51	— 5	24.7	1.51	13.7
Portage	50	— 5	26.2	1.37	10.0
Port Washington	50	3	27.0	1.55	5.0
Prairie du Chien	54	— 7	27.4	0.91	11.9
Prentice	45	—11	21.6	1.42	18.5
Racine	52	11	30.1	1.15	
Sheboygan	49	4	29.1	0.99	1.5
Spooner	42	—14	19.2	0.22	5.5
Stanley	43	— 9	20.6	0.65	7.5
Stevens Point	45	0	24.2	1.34	17.5
Sturgeon Bay Canal	48	0	28.0	2.66	15.2
Valley Junction	48	— 5	24.8	0.66	6.7

TABLE II.—*Climatological record of cooperative observers*—Continued. *Late reports for November.*

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Wisconsin—Cont'd.	°	°	°	*Ins.*	*Ins.*
Viroqua	46	— 5	24.8	1.51	15.5
Watertown	50	— 3	25.3	1.43	7.5
Waukesha				1.02	5.0
Waupaca	43	— 4	23.2	1.22	18.8
Wausau	45	— 3	23.6	1.12	16.5
Whitehall	55	— 7	22.3	1.00	10.0
Wyoming.					
Afton		—17		1.00	14.0
Barnum				0.18	1.8
Basin				0.10	1.0
Bedford	42	—13	14.3	0.81	8.1
Border	40	—29	7.8	0.52	
Buffalo	60	— 5	25.0	0.05	0.5
Cambria	51	1	26.5	0.10	1.0
Chugwater	65	— 1	27.9	T.	T.
Clark				0.07	1.0
Cody	59[2]	— 9[2]	25.1[2]		
Daniel	45	—21	12.8	0.10	1.0
Elk Mountain				0.69	7.2
Embar[2]		— 6	23.8	0.01	1.0
Evanston	47	—15	16.6	0.32	3.0
Fayette	48	—22	16.9	0.30	3.0
Fort Laramie	54	— 1	25.6	T.	T.
Fort Washakie	42	—13	14.8	0.21	3.0
Granite Canyon	54	1	25.6	T.	T.
Granite Springs				0.06	0.6
Green River	44	— 9	17.4	0.04	1.2
Griggs	56	—22	23.4	0.37	3.7
Hatton				0.07	0.7
Hyattville	55	— 3	25.6	T.	T.
Iron Mountain	54	1	28.7	0.05	0.5
Kirtley	53	— 9	24.8	0.05	1.1
Laramie	56	— 5	22.2	0.03	0.4
Little Medicine	44	—19	12.6	0.10	1.5
Lolabama Ranch		—10		0.00	
Lusk	57	— 6	24.0	0.20	2.0
Moore	59	3	25.6	0.03	1.2
Moorcroft	56	—14	24.4	0.30	3.0
Pathfinder				0.04	1.2
Phillips	64	0	28.9	0.00	
Pine Bluff	64	— 1	27.8	0.00	
Sheridan	57	— 2	26.0	0.10	1.0
South Pass City	49	—21	12.4	0.70	7.0
Thayne	42	—17	13.3	0.88	10.1
Wolf	63	5	33.8	0.10	1.0
Yellowstone Pk. (G. Can.)	33	—22	11.0	1.75	17.5
Yellowstone Pk. (Norris)	35	—30	8.4	1.25	
Yellowstone Pk (Snake R)				0.80	8.0
Yellowstone Pk. (Soda B.)	39	—23	13.4	0.64	6.7
Yellowstone Pk. (Thumb)	39	—30	8.9	1.05	
Yellowstone Pk. (Up. B.)	36	—29	12.2	1.23	15.5
Porto Rico.					
Adjuntas	92	49	71.8	4.21	
Aguirre	90	61	77.3	2.87	
Albonito	80	57	69.2	3.65	
Arecibo	91	58	73.8	1.56	
Barros	80	54	69.2	2.48	
Bayamon	89	58	74.0	3.69	
Caguas	88	56	72.5	7.08	
Porto Rico—Cont'd.					
Canovanas	85	67	76.6	3.18	
Cayey	86	68	76.8	2.60	
Cidra	85	51	68.3	1.90	
Coloso	92	67	79.2	0.15	
Fajardo	89	66	79.1	3.85	
Guanica	91	59	75.0	1.11	
Hacienda Josefa				4.14	
Humacao	85	70	77.7	5.38	
Ingenio				5.41	
Isabela	87	60	74.8	2.03	
Juana Diaz	92	65	79.3	2.79	
La Carmelita	86	60	73.0	2.96	
Lares	90	56	72.7	0.75	
Las Cruces	85	58	70.5	3.33	
Las Marias	89	58	73.9	3.54	
Manati	91	62	75.8	2.75	
Maunabo	90	67	79.4	4.08	
Mayaguez	91	59	76.0	1.99	
Ponce	87	61	76.2	1.40	
Rio Blanco	87	62	76.5	4.38	
Rio Piedras				3.26	
San German	91	60	76.4	1.38	
San Lorenzo	88	57	73.0	3.49	
San Salvador	86	59	71.4	1.72	
Vieques	91	70	78.3	2.17	
Yauco[5]	87	58	74.8		
New Brunswick.					
St. John	47	0	25.6	5.42	15.6

Late reports for November, 1905.

	°	°	°	*Ins.*	*Ins.*
Alaska.					
Eagle	50	—17	14.7	0.50	5.0
Fairbanks	40	—25	12.6	1.20	12.0
Fort Egbert	42	— 8	14.4	0.93	7.0
Fort Gibbon	36	—30	10.0	1.10	10.5
Rampart	37	—29	6.9	1.43	14.5
Tanana	37	—20	7.4	0.60	6.0
Arizona.					
Arizona Canal Co. Dam	91	29	62.0	3.22	
Arkansas.					
Mossville	75	16	50.2	3.42	
California.					
Nimshew				1.92	7.7
Orland	83	28	54.2	1.45	
Ventura	80	40	59.8	1.57	
Idaho.					
Minkcreek				0.50	5.0
Westlake				1.63	
Iowa.					
Fayette	61	1	35.2	2.81	T.
Kansas.					
Pratt	73	14	47.0	2.30	
Minnesota.					
St. Cloud	60	—23	34.1	2.93	10.0
Two Harbors	62	2	34.2	2.07	5.0
Montana.	°	°	°	*Ins.*	*Ins.*
Anaconda	63	—10	33.5	0.45	
Toston	60	—11	28.4	0.10	1.0
New Hampshire.					
Jefferson Highland				1.94	8.0
New Jersey.					
Sandy Hook	64	21	44.0	1.44	T.
Ohio.					
New Berlin	60	15	37.8	2.10	T.
Washington.					
Sunnyside		18		0.22	1.5
West Virginia.					
Huntington	70	20	42.3	3.30	T.
Point Pleasant	66	22	44.8	4.04	T.
Wisconsin.					
Butternut	59	1	30.4	2.66	13.6
Wyoming.					
Basin	57	—11	33.0	0.53	
Wells	60	—23	27.3	0.60	11.5

EXPLANATION OF SIGNS.

• Extremes of temperature from observed readings of dry thermometer.

A numeral following the name of a station indicates the hours of observation from which the mean temperature was obtained, thus:

[1] Mean of 7 a. m. + 2 p. m. + 9 p. m. + 9 p. m. + 4.
[2] Mean of 8 a. m. + 8 p. m. + 2.
[3] Mean of 7 a. m. + 7 p. m. + 2.
[4] Mean of 6 a. m. + 6 p. m. + 2.
[5] Mean of 7 a. m. + 2 p. m. + 2.
[6] Mean of readings at various hours reduced to true daily mean by special tables.

The absence of a numeral indicates that the mean temperature has been obtained from daily readings of the maximum and minimum thermometers.

An italic letter following the name of a station, as "Livingston *a*," "Livingston *b*," indicates that two or more observers, as the case may be, are reporting from the same station. A small roman letter following the name of a station, or in figure columns, indicates the number of days missing from the record; for instance, "[a]" denotes 14 days missing.

No note is made of breaks in the continuity of temperature records when the same do not exceed two days. All known breaks of whatever duration, in the precipitation record receive appropriate notice.

CORRECTIONS.

June, 1905, Alabama, Bridgeport, make precipitation 5.39 instead of 6.99.

August, 1905, New Mexico, Arabela, make precipitation 1.98 instead of 2.70.

November, 1905, Iowa, Humboldt, make mean temperature 38.4 instead of 38.5; North Carolina, Lincolnton, make mean temperature 48.7 instead of 48.8.

TABLE III.—*Resultant winds from observations at 8 a. m. and 8 p. m., daily, during the month of December, 1905.*

Stations.	Component direction from—				Resultant.	
	N.	S.	E.	W.	Direction from—	Duration.
New England.	*Hours.*	*Hours.*	*Hours.*	*Hours.*	°	*Hours.*
Eastport, Me	23	6	9	37	n. 59 w.	33
Portland, Me	24	12	4	37	n. 70 w.	35
Concord, N. H.†	14	5	8	13	n. 29 w.	10
Northfield, Vt	20	34	4	13	s. 33 w.	17
Boston, Mass	21	12	4	33	n. 73 w.	30
Nantucket, Mass	19	14	10	34	n. 79 w.	26
Block Island, R. I	21	14	5	34	n. 76 w.	30
Providence, R. I	22	7	4	36	n. 65 w.	35
Hartford, Conn	23	26	4	22	s. 81 w.	18
New Haven, Conn	24	12	12	28	n. 53 w.	20
Middle Atlantic States.						
Albany, N. Y	23	26	8	17	s. 72 w.	10
Binghamton, N. Y.†	12	8	9	14	n. 51 w.	6
New York, N. Y	20	9	11	35	n. 65 w.	26
Harrisburg, Pa	19	12	12	33	n. 72 w.	22
Philadelphia, Pa	26	16	8	31	n. 65 w.	21
Scranton, Pa	18	20	12	29	s. 83 w.	17
Atlantic City, N. J	23	11	6	34	n. 67 w.	30
Cape May, N. J	26	15	7	28	n. 62 w.	24
Baltimore, Md	24	10	7	36	n. 64 w.	32
Washington, D. C	26	20	6	22	n. 69 w.	17
Lynchburg, Va	19	18	14	29	n. 86 w.	15
Mount Weather, Va	25	11	8	37	n. 64 w.	32
Norfolk, Va	26	20	16	14	n. 18 e.	6
Richmond, Va	27	21	10	12	n. 18 w.	6
Wytheville, Va	12	9	15	38	n. 83 w.	23
South Atlantic States.						
Asheville, N. C	27	16	15	21	n. 29 w.	12
Charlotte, N. C	27	16	23	16	n. 32 e.	13
Hatteras, N. C	32	9	19	16	n. 7 e.	23
Raleigh, N. C	32	12	10	22	n. 31 w.	23
Wilmington, N. C	32	11	13	19	n. 17 w.	21
Charleston, S. C	38	10	9	15	n. 12 w.	29
Columbia, S. C	27	12	25	17	n. 28 e.	17
Augusta, Ga	31	12	17	21	n. 12 w.	19
Savannah, Ga	36	8	12	18	n. 12 w.	29
Jacksonville, Fla	35	9	10	21	n. 23 w.	28
Florida Peninsula.						
Jupiter, Fla	24	17	16	19	n. 23 w.	8
Key West, Fla	29	13	29	8	n. 53 e.	26
Tampa, Fla	35	8	20	16	n. 8 e.	27
Eastern Gulf States.						
Atlanta, Ga	27	9	20	23	n. 9 w.	18
Macon, Ga.†	18	5	10	10	n.	13
Pensacola, Fla.†	20	1	9	8	n. 3 e.	19
Birmingham, Ala.†	17	5	10	7	n. 14 e.	12
Mobile, Ala	35	11	15	13	n. 5 e.	24
Montgomery, Ala	28	9	20	19	n. 3 e.	19
Meridian, Miss.†	13	5	11	9	n. 14 e.	8
Vicksburg, Miss	27	13	23	11	n. 41 e.	18
New Orleans, La	33	7	21	13	n. 17 e.	27
Western Gulf States.						
Shreveport, La	28	11	19	18	n. 3 e.	17
Fort Smith, Ark	17	11	28	15	n. 65 e.	14
Little Rock, Ark	22	15	16	24	n. 49 w.	11
Corpus Christi, Tex	39	8	11	16	n. 9 w.	31
Fort Worth, Tex	25	18	14	20	n. 41 w.	9
Galveston, Tex	32	8	17	16	n. 2 e.	24
Palestine, Tex	35	7	20	11	n. 18 e.	29
San Antonio, Tex	32	9	14	20	n. 15 w.	24
Taylor, Tex.†	16	4	6	11	n. 23 w.	13
Ohio Valley and Tennessee.						
Chattanooga, Tenn	21	17	16	25	n. 66 w.	10
Knoxville, Tenn	28	16	19	19	n.	12
Memphis, Tenn	27	19	20	12	n. 45 e.	11
Nashville, Tenn	20	20	8	28	w.	20
Lexington, Ky.†	9	11	8	12	s. 63 w.	4
Louisville, Ky	17	26	9	21	s. 53 w.	15
Evansville, Ind.†	12	12	5	10	w.	5
Indianapolis, Ind	14	29	10	26	s. 73 w.	17
Cincinnati, Ohio	13	22	16	27	s. 51 w.	14
Columbus, Ohio	13	30	14	23	s. 28 w.	19
Pittsburg, Pa	14	22	11	33	s. 70 w.	23
Parkersburg, W. Va	7	27	9	29	s. 45 w.	28
Elkins, W. Va	9	22	10	35	s. 63 w.	28
Lower Lake Region.						
Buffalo, N. Y	9	20	12	35	s. 64 w.	26
Oswego, N. Y	10	33	9	19	s. 23 w.	25
Rochester, N. Y	6	25	7	38	s. 59 w.	36
Syracuse, N. Y	1	33	11	25	s. 24 w.	35
Erie, Pa	6	30	9	32	s. 44 w.	33
Cleveland, Ohio	6	39	10	19	s. 15 w.	34
Sandusky, Ohio†	4	14	5	17	s. 50 w.	16
Toledo, Ohio	8	29	7	32	s. 50 w.	33
Detroit, Mich	8	23	8	36	s. 62 w.	32
Upper Lake Region.						
Alpena, Mich	12	20	9	37	s. 74 w.	29
Escanaba, Mich	18	17	7	35	n. 88 w.	28
Grand Rapids, Mich	9	28	12	26	s. 36 w.	24
Houghton, Mich.†	9	2	10	12	n. 16 w.	7
Marquette, Mich	14	23	8	33	s. 70 w.	27
Port Huron, Mich	6	29	9	24	s. 33 w.	28
Sault Ste. Marie, Mich	15	19	27	18	s. 66 e.	10
Chicago, Ill	11	18	8	39	s. 77 w.	32
Milwaukee, Wis	11	17	6	41	s. 80 w.	36
Green Bay, Wis	9	29	4	34	s. 56 w.	36
Duluth, Minn	12	15	5	32	s. 84 w.	27
North Dakota.						
Moorhead, Minn	23	25	5	24	s. 84 w.	19
Bismarck, N. Dak	18	8	19	30	n. 48 w.	15
Devils Lake, N. Dak	12	22	11	33	s. 66 w.	24
Williston, N. Dak	9	25	9	28	s. 50 w.	25
Upper Mississippi Valley.						
Minneapolis, Minn.*	6	10	4	19	s. 75 w.	16
St. Paul, Minn	17	22	11	27	s. 76 w.	16
La Crosse, Wis.†	7	12	3	11	s. 58 w.	9
Madison, Wis	13	24	7	29	s. 64 w.	25
Charles City, Iowa	16	26	11	24	s. 52 w.	16
Davenport, Iowa	23	13	12	32	n. 63 w.	22
Des Moines, Iowa	16	21	8	35	s. 80 w.	28
Dubuque, Iowa	16	20	9	28	s. 78 w.	19
Keokuk, Iowa	16	27	9	30	s. 62 w.	24
Cairo, Ill	24	24	6	22	w.	16
La Salle, Ill.†	5	7	7	19	s. 81 w.	12
Peoria, Ill	6	10	2	15	s. 73 w.	14
Springfield, Ill	11	23	9	27	s. 56 w.	22
Hannibal, Mo.†	7	10	3	20	s. 80 w.	17
St. Louis, Mo	17	21	17	25	s. 56 w.	7
Missouri Valley.						
Columbia, Mo.*	9	13	7	11	s. 45 w.	6
Kansas City, Mo	16	27	10	24	s. 52 w.	18
Springfield, Mo	21	23	16	18	s. 45 w.	3
Topeka, Kans.*	9	14	5	11	s. 50 w.	8
Lincoln, Nebr	18	19	5	20	s. 86 w.	15
Omaha, Nebr	20	27	5	25	s. 71 w.	21
Valentine, Nebr	23	10	3	40	n. 71 w.	39
Sioux City, Iowa†	8	12	7	11	s. 45 w.	6
Pierre, S. Dak	23	15	15	28	n. 58 w.	15
Huron, S. Dak	21	20	13	25	n. 85 w.	12
Yankton, S. Dak.†	9	9	4	16	w.	12
Northern Slope.						
Havre, Mont	11	17	9	39	s. 79 w.	31
Miles City, Mont	4	39	7	14	s. 11 w.	36
Helena, Mont	15	19	4	38	s. 83 w.	34
Kalispell, Mont	23	8	0	45	n. 72 w.	47
Rapid City, S. Dak	19	4	7	45	n. 69 w.	41
Cheyenne, Wyo	27	6	1	43	n. 63 w.	47
Lander, Wyo	28	14	31	7	n. 60 e.	28
Yellowstone Park, Wyo	5	43	5	25	s. 28 w.	43
North Platte, Nebr	11	16	12	33	s. 77 w.	22
Middle Slope.						
Denver, Colo	13	36	4	17	s. 29 w.	26
Pueblo, Colo	23	5	13	33	n. 48 w.	27
Concordia, Kans	13	29	12	18	s. 21 w.	17
Dodge, Kans	19	22	13	20	s. 67 w.	8
Wichita, Kans	20	24	18	15	s. 37 e.	5
Oklahoma, Okla	28	23	5	12	n. 54 w.	9
Southern Slope.						
Abilene, Tex	24	25	6	18	s. 85 w.	12
Amarillo, Tex	21	25	3	28	s. 81 w.	25
Roswell, N. Mex.	31	12	8	25	n. 42 w.	26
Southern Plateau.						
El Paso, Tex	25	2	25	24	n. 2 e.	23
Santa Fe, N. Mex	38	7	28	9	n. 31 e.	36
Flagstaff, Ariz	29	6	22	16	n. 15 e.	24
Phoenix, Ariz	10	15	29	17	s. 67 e.	13
Yuma, Ariz	47	4	11	7	n. 5 e.	43
Independence, Cal	29	13	6	27	n. 53 w.	26
Middle Plateau.						
Reno, Nev	11	19	18	28	s. 51 w.	13
Winnemucca, Nev	29	15	27	13	n. 45 e.	20
Modena, Utah	17	9	22	27	n. 32 w.	9
Salt Lake City, Utah	17	19	27	16	s. 80 e.	11
Durango, Colo	40	9	4	21	n. 29 w.	35
Grand Junction, Colo	17	20	29	12	s. 80 e.	17
Northern Plateau.						
Baker City, Oreg						
Boise, Idaho	28	13	15	23	n. 49 w.	11
Lewiston, Idaho†	1	6	22	3	s. 75 e.	20
Pocatello, Idaho	5	19	25	24	s. 4 e.	14
Spokane, Wash	20	21	21	15	s. 80 e.	6
Walla Walla, Wash	6	39	11	17	s. 10 w.	34
North Pacific Coast Region.						
North Head, Wash	5	28	29	11	s. 38 e.	29
Port Crescent, Wash.*	4	16	15	6	s. 37 e.	15
Seattle, Wash	3	36	31	6	s. 37 e.	41
Tacoma, Wash	5	42	6	26	s. 28 w.	42
Tatoosh Island, Wash	3	29	24	10	s. 28 e.	30
Portland, Oreg	6	29	24	19	s. 12 e.	24
Roseburg, Oreg	13	28	25	10	s. 45 e.	21
Middle Pacific Coast Region.						
Eureka, Cal	16	26	20	13	s. 35 e.	12
Mount Tamalpais, Cal	36	9	13	12	n. 2 e.	27
Red Bluff, Cal	38	13	7	7	n.	25
Sacramento, Cal	25	18	26	8	n. 69 e.	19
San Francisco, Cal	35	9	14	20	n. 13 w.	27
South Pacific Coast Region.						
Fresno, Cal	22	15	19	17	n. 16 e.	7
Los Angeles, Cal	22	7	20	27	n. 25 w.	17
San Diego, Cal	36	3	19	19	n.	33
San Luis Obispo, Cal	44	5	11	14	n. 4 w.	39
West Indies						
Grand Turk, W.I	2	12	23	0	s. 67 e.	25
Hamilton, Bermuda	23	23	9	23	w.	14
San Juan, Porto Rico	1	29	45	1	s. 57 e.	52

* From observations at 8 p. m. only. † From observations at 8 a. m. only.

TABLE IV.—*Accumulated amounts of precipitation for each 5 minutes, for storms in which the rate of fall equaled or exceeded 0.25 in any 5 minutes, or 0.75 in 1 hour during December, 1905, at all stations furnished with self-registering gages.*

Stations.	Date.	Total duration. From—	Total duration. To—	Total amount of precipitation.	Excessive rate. Began—	Excessive rate. Ended—	Amount before excessive began.	Depths of precipitation (in inches) during periods of time indicated. 5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
1	1	2	3	4	5	6	7														
Albany, N. Y.	2-3			0.77														*			
Alpena, Mich.	21			0.58														*			
Amarillo, Tex.	12-13			1.15														*			
Asheville, N. C.	2-3			2.61														0.50			
Atlanta, Ga.	2-3	10:20 a. m.	D. N.	4.64	6:46 p. m.	7:36 p. m.	1.47	0.06	0.16	0.32	0.50	0.69	0.81	0.95	1.05	1.16	1.27				
					7:36 p. m.	8:26 p. m.	.....	1.35	1.41	1.47	1.52	1.59	1.66	1.72	1.79	1.84	1.87	.....			
					8:26 p. m.	9:13 p. m.	.....	1.96	2.05	2.14	2.20	2.25	2.30	2.37	2.42	2.50	.....	.....			
Atlantic City, N. J.	3			1.19														0.54			
Augusta, Ga.	2-3	3:52 p. m.	9:10 a. m.	2.31	10:42 p. m.	11:22 p. m.	0.48	0.09	0.19	0.31	0.41	0.45	0.51	0.61	0.68	.....	.....	.....			
Baltimore, Md.	20-21			1.56														0.38			
Binghamton, N. Y.	2-3			1.41														0.14			
Birmingham, Ala.	2			1.60														0.26			
Bismarck, N. Dak.	22			0.08														*			
Block Island, R. I.	3			1.05														0.48			
Boise, Idaho.	18-20			0.30														0.05			
Boston, Mass.	21			0.85														0.26			
Buffalo, N. Y.	20-21			0.92														*			
Cairo, Ill.	1-2			2.02														*			
Charles City, Iowa.	20-21			0.41														*			
Charleston, S. C.	23			0.70														0.43			
Charlotte, N. C.	2-3			1.78														0.53			
Chattanooga, Tenn.	14-15			1.23														0.28			
Cheyenne, Wyo.	26			0.01																	
Chicago, Ill.	20-21			0.25														*			
Cincinnati, Ohio.	1-2			1.38														0.29			
Cleveland, Ohio.	20-21			0.56														0.18			
Columbia, Mo.	27-28			0.54														0.12			
Columbia, S. C.	2-3			2.33														0.64			
Columbus, Ohio.	1-2			0.73														0.08			
Concord, N. H.	2-3			2.34														*			
Corpus Christi, Tex.	18	8:41 a. m.	12:16 p. m.	0.70	11:27 a. m.	11:57 a. m.	0.04	0.20	0.34	0.38	0.40	0.50	0.65	.....	.....	.....	.....	.....			
Davenport, Iowa.	28-29			0.86														*			
Denver, Colo.	1-2			T.																	
Des Moines, Iowa.	20-21			0.35														*			
Detroit, Mich.	20-21			1.05														*			
Dodge, Kans.	30			T.																	
Dubuque, Iowa.	28-29			0.75														*			
Duluth, Minn.	2			0.04														*			
Eastport, Me.	2-3			1.06														0.16			
Elkins, W. Va.	2-4			1.13														0.17			
Erie, Pa.	20-21			0.28														*			
Escanaba, Mich.	28-29			0.93														*			
Evansville, Ind.	1-2			1.64														0.22			
Fort Smith, Ark.	1			0.70														0.17			
Fort Worth, Tex.	12-14			2.13														0.19			
Galveston, Tex.	12-13			2.94														0.40			
Grand Rapids, Mich.	28-29			0.45														0.09			
Green Bay, Wis.	28-29			0.59														*			
Hannibal, Mo.	28			0.88														0.09			
Harrisburg, Pa.	2-3			1.73														0.29			
Hartford, Conn.	29			1.03														0.51			
Hatteras, N. C.	9			1.36														0.62			
Huron, S. Dak.	23			0.03														*			
Indianapolis, Ind.	20-21			0.97														*			
Iola, Kans.	20-21			0.30														*			
Jacksonville, Fla.	20-21	2:55 p. m.	D. N.	1.27	3:16 p. m.	3:24 p. m.	0.01	0.54	0.77	...											
Jupiter, Fla.	6-7	3:33 p. m.	5:00 p. m.	5.77	2:28 a. m.	3:18 a. m.	0.27	0.09	0.14	0.20	0.28	0.55	0.84	1.10	1.33	1.56	1.71	.....			
					3:18 a. m.	4:08 a. m.	.....	1.89	2.12	2.25	2.36	2.46	2.58	2.71	2.82	2.95	3.14	.....			
					4:08 a. m.	5:09 a. m.	.....	3.19	3.26	3.43	3.58	3.73	3.90	4.00	4.09	4.18	4.27	4.35			
Do.	26-27	1:40 p. m.	2:00 a. m.	1.25	9:52 p. m.	10:22 p. m.	0.49	0.08	0.13	0.24	0.43	0.58	0.70	.....	.....	.....	.....	.....			
Kansas City, Mo.	20-21			0.27														*			
Key West, Fla.	19	2:10 p. m.	3:40 p. m.	0.77	2:37 p. m.	3:12 p. m.	0.11	0.05	0.10	0.20	0.38	0.51	0.59	0.64	.....	.....	.....	.....			
Do.	29	4:10 a. m.	5:55 a. m.	0.81	4:20 a. m.	5:02 a. m.	0.01	0.13	0.26	0.35	0.38	0.41	0.47	0.59	0.68	.....	.....	.....			
Knoxville, Tenn.	23			1.08														0.49			
La Crosse, Wis.	21			0.58														*			
La Salle, Ill.	28-29			0.75														0.12			
Lexington, Ky.	14-15			1.81														*			
Lincoln, Nebr.	1			0.06														*			
Little Rock, Ark.	1-2			1.99														0.39			
Los Angeles, Cal.	31			0.15														0.08			
Louisville, Ky.	1-2			2.87														0.38			
Lynchburg, Va.	20-21			1.84														0.34			
Macon, Ga.	19-20			2.63														0.41			
Madison, Wis.	28-29			0.58														0.08			
Memphis, Tenn.	1-2			1.87														0.33			
Meridian, Miss.	2			0.69														0.31			
Milwaukee, Wis.	20-21			0.53														0.07			
Minneapolis, Minn.	4			0.02																	
Montgomery, Ala.	19-20			2.32														0.59			
Mount Weather, Va.	20-21			1.61														*			
Nantucket, Mass.	3			0.90														0.62			
Nashville, Tenn.	14-15			1.65														0.41			
New Haven, Conn.	2-3			2.12														0.39			
New Orleans, La.	2	7:20 a. m.	3:15 p. m.	2.72	9:34 a. m.	10:15 a. m.	0.04	0.16	0.40	0.56	0.66	0.82	0.92	0.97	1.05	.....	.....	.....			
					11:56 a. m.	12:22 p. m.	1.49	0.10	0.42	0.63	0.76	0.84	0.89								
Do.	12-14	8:15 p. m.	9:55 a. m.	3.78	†4:25 a. m.	†5:30 a. m.	1.72	0.09	0.27	0.43	0.59	0.69	0.82	0.95	1.07	1.21	1.32	1.53			
Do.	27-28	2:10 p. m.	5:15 a. m.	4.36	11:24 p. m.	1:02 a. m.	2.10	0.12	0.24	0.39	0.42	0.48	0.59	0.68	0.70	0.71	0.73	0.83	1.20	1.66	.....
New York, N. Y.	29			0.75														0.56			
Norfolk, Va.	3			0.65														0.32			
Northfield, Vt.	3			1.07														*			
North Head, Wash.	26			0.74														0.40			
Oklahoma, Okla.	21-22			0.21														0.07			
Omaha, Nebr.	1-2			0.14														0.05			
Palestine, Tex.	18-19			1.55														0.38			
Parkersburg, W. Va.	20-21			0.46														0.15			
Pensacola, Fla.	2-3	4:40 a. m.	3:15 a. m.	3.16	6:22 p. m.	7:22 p. m.	0.94	0.14	0.38	0.55	0.62	0.72	0.81	0.89	1.05	1.14	1.30	1.59			
Do.	28	1:55 a. m.	9:40 a. m.	1.74	6:05 a. m.	6:30 a. m.	0.36	0.18	0.41	0.67	0.75	0.80	.....	.....	.....	.....	.....	.....			
Peoria, Ill.	28-29			1.08														*			
Philadelphia, Pa.	28-29			0.56														0.28			
Pittsburg, Pa.	20-21			0.69														0.22			

TABLE IV.—*Accumulated amounts of precipitation for each 5 minutes, etc.*—Continued.

Stations.	Date.	Total duration. From—	Total duration. To—	Total amount of precipitation.	Excessive rate. Began—	Excessive rate. Ended—	Amount before excessive began.	Depths of precipitation (in inches) during periods of time indicated. 5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
	1	2	3	4	5	6	7														
Portland, Me	2-3			1.91														0.32			
Portland, Oreg	25-26			0.53														0.30			
Pueblo, Colo	27			0.10														*			
Raleigh, N. C	2-3			2.00														*			
Richmond, Va	20-21			2.04														0.52			
Rochester, N. Y.	21			1.03														*			
Sacramento, Cal	30			0.19														0.12			
St. Louis, Mo	1			0.65														0.18			
St. Paul, Minn	21			0.02														*			
Salt Lake City, Utah	1			0.18														*			
San Antonio, Tex	11-13			1.00														0.18			
San Diego, Cal	31			0.20														0.20			
Sandusky, Ohio	20-21			0.89														*			
San Francisco, Cal	20			0.65														0.23			
Savannah, Ga	23			0.51														0.40			
Scranton, Pa	2-3			1.57														0.30			
Seattle, Wash	26			0.48														0.35			
Shreveport, La	1-2			1.24														0.54			
Spokane, Wash	17			0.41														*			
Springfield, Ill	28-29			1.11														*			
Springfield, Mo	20-21			1.04														*			
Syracuse, N. Y	2-4			1.52														*			
Tampa, Fla	14			1.55														0.70			
Taylor, Tex	30			0.43														0.23			
Toledo, Ohio	20-21			0.94														*			
Topeka, Kans	20-21			0.20														*			
Valentine, Nebr	22-23			0.03														*			
Vicksburg, Miss	19			0.71														0.46			
Washington, D. C	20-21			2.03														0.40			
Wichita, Kans	30			0.09														0.04			
Williston, N. Dak	1			0.04														*			
Wilmington, N. C	20-21			1.14					0.50												
Wytheville, Va	2-3			1.99														0.35			
Yankton, S. Dak	21			0.03														*			
Cienfuegos, Cuba																					
San Juan, Porto Rico	1-2			0.91														0.37			
Santiago de Cuba																					
Santo Domingo, S. D.																					

* Self-register not working † Of 14th.

TABLE V.—*Data furnished by the Canadian Meteorological Service, December, 1905.*

Stations.	Pressure, in inches. Actual, reduced to mean of 24 hours.	Pressure, in inches. Sea level, reduced to mean of 24 hours.	Pressure, in inches. Departure from normal.	Temperature. Mean.	Temperature. Departure from normal.	Temperature. Mean maximum.	Temperature. Mean minimum.	Precipitation. Total.	Precipitation. Departure from normal.	Precipitation. Total snowfall.
	Ins.	*Ins.*	*Ins.*	°	°	°	°	*Ins.*	*Ins.*	*Ins.*
St. Johns, N. F	29.62	29.76	—.07	26.8	— 1.9	32.9	20.7	4.74	—0.29	10.5
Sydney, C. B. I	29.88	29.92	+.03	28.9	+ 0.7	34.8	23.0	4.83	+0.20	13.5
Halifax, N. S	29.90	30.01	+.05	30.1	+ 2.5	36.2	24.1	6.63	+1.51	1.5
Grand Manan, N. B	29.92	29.97	—.01	30.5	+ 2.2	37.2	23.8	7.04	+2.62	13.7
Yarmouth, N. S	29.94	30.01	+.03	32.5	+ 1.8	38.6	26.4	3.07	—1.97	8.4
Charlottetown, P. E. I	29.92	29.96	+.02	25.4	+ 1.1	30.6	20.2	4.84	+1.18	20.9
Chatham, N. B	29.96	29.99	+.05	20.3	+ 1.3	28.9	11.6	4.31	+1.09	40.9
Father Point, Que	29.96	29.99	+.04	19.0	+ 3.6	25.8	12.1	1.90	—0.93	19.0
Quebec, Que	29.69	30.03	+.02	16.7	+ 1.5	23.1	10.3	2.77	—0.92	27.5
Montreal, Que	29.82	30.04	+.01	21.8	+ 3.5	28.9	14.7	3.83	+0.18	26.9
Rockliffe, Ont										
Ottawa, Ont	29.68	30.02	.00	21.7	+ 4.7	29.1	14.2	2.33	—0.58	16.9
Kingston, Ont	29.74	30.07	+.03	26.7	+ 3.0	33.5	19.9	3.21	—0.03	11.1
Toronto, Ont	29.66	30.06	+.01	31.3	+ 4.3	36.8	25.7	2.28	—0.63	6.1
White River, Ont	28.60	29.97	.00	14.6	+ 4.9	25.8	3.4	1.21	—0.50	12.1
Port Stanley, Ont	29.42	30.08	+.01	30.9	+ 2.5	36.7	25.1	1.91	—0.51	3.6
Saugeen, Ont	29.30	30.03	+.01	29.5	+ 2.8	35.3	23.8	3.63	—0.35	19.8
Parry Sound, Ont	29.30	30.02	+.01	24.9	+ 3.7	32.3	17.4	3.13	—1.35	23.5
Port Arthur, Ont	29.26	29.99	.00	18.7	+ 5.5	28.4	9.1	0.10	—0.77	1.0
Winnipeg, Man	29.12	29.99	—.03	11.6	+ 7.5	21.4	1.7	0.41	—0.50	4.1
Minnedosa, Man	28.08	29.98	—.04	15.4	+ 9.7	25.6	5.1	0.81	+0.19	8.1
Qu'Appelle, Assin	27.61	29.94	—.06	17.1	+ 9.7	25.6	8.6	0.33	—0.19	3.3
Medicine Hat, Assin	27.64	29.98	+.01	26.0	+ 7.8	34.7	17.4	0.05	—0.50	0.5
Swift Current, Assin	27.34	30.01	+.02	21.7	+ 5.7	30.1	13.2	0.11	—0.67	1.1
Calgary, Alberta	26.30	29.95	+.01	24.6	+ 6.4	34.1	15.1	T.	—0.59	T.
Banff, Alberta	25.30	30.06	+.12	22.4	+ 3.3	29.3	15.4	0.45	—0.76	4.5
Edmonton, Alberta										
Prince Albert, Sask	28.28	29.91	—.10	14.5	+11.7	23.9	5.2	0.72	—0.02	7.2
Battleford, Sask	28.16	29.96	—.03	15.7	+10.3	25.1	16.4	0.04	—0.28	0.4
Kamloops, B. C	28.79	30.04	+.10	30.5	+ 1.6	35.6	25.4	0.37	—0.41	2.7
Victoria, B. C	29.96	30.06	+.09	42.6	+ 1.4	46.1	39.1	2.82	—5.16	0.0
Barkerville, B. C	25.54	29.92	+.04	24.1	+ 3.2	30.0	18.2	2.80	—0.87	28.0
Hamilton, Bermuda	29.99	30.15	+.03	66.4	+ 1.7	71.1	61.6	9.64	+5.15	
Dawson, Yukon										

TABLE VI.—*Heights of rivers referred to zeros of gages, December, 1905.*

Stations.	Distance to mouth of river.	Danger line on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Milk River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Havre, Mont. (8)	237	9	.....	.....	.....	.....	.....	.....
James River.								
Huron, S. Dak. (31)	139	9	.....	.....	.....	.....	.....	.....
Republican River.								
Clay Center, Kans.	42	18	6.7	11-14,25-27	6.3	1	6.5	0.4
Smoky Hill River.								
Abilene, Kans.	45	22	1.7	1,2	1.0	6-8,10,13,21,25	1.2	0.7
Kansas River.								
Manhattan, Kans.	116	18	3.4	22-25	2.8	4	3.1	0.6
Topeka, Kans.	87	21	7.4	1	6.5	20,21	6.8	0.9
Missouri River.								
Bismarck, N. Dak.	1,309	14	1.5	31	— 0.9	1	—0.1	2.4
Pierre, S. Dak. (31)	1,114	14	.....	.....	.....	.....	.....	.....
Sioux City, Iowa	784	19	5.5	5	1.6	3	4.3	3.9
Blair, Nebr.	705	15	5.3	13	4.2	31	5.0	1.1
Omaha, Nebr (32)	669	18	4.2	24	3.3	3	.....	0.9
St. Joseph, Mo	481	10	2.9	1	— 2.1	5	0.3	5.0
Kansas City, Mo.	388	21	8.5	1	4.5	6	6.3	4.0
Glasgow, Mo.	231	18	8.0	1	3.4	9	4.3	4.6
Boonville, Mo.	199	20	9.5	1	6.3	9,10	7.1	3.2
Hermann, Mo.	103	24	9.3	1	6.0	16,17,20-22,25-28	6.7	3.3
Minnesota River.								
Mankato, Minn.	127	18	8.0	2	3.6	30,31	5.3	4.4
St. Croix River.								
Stillwater, Minn. (31)	23	11	.....	.....	.....	.....	.....	.....
Red Cedar River.								
Cedar Rapids, Iowa	77	14	3.7	9	2.9	4,5	3.2	0.8
Iowa River.								
Iowa City, Iowa.	57	.....	1.3	10	— 0.7	25	0.2	2.0
Des Moines River.								
Des Moines, Iowa.	205	19	4.2	9,10	3.0	26-30	3.4	1.2
Illinois River.								
La Salle, Ill	197	18	13.7	5	11.7	25	12.4	2.0
Peoria, Ill.	135	14	8.8	31	8.0	1-3	8.3	0.8
Red Bank Creek.								
Brookville, Pa.	42	8	4.0	3	0.4	10-20,26-28	0.9	3.6
Clarion River.								
Clarion, Pa.	32	10	9.3	3	1.8	20	3.7	7.5
Conemaugh River.								
Johnstown, Pa.	64	7	9.5	3	2.0	18-20	3.1	7.5
Allegheny River								
Warren, Pa.	177	14	6.0	30	1.0	20,21	3.2	5.0
Franklin, Pa	114	15	7.6	1	1.5	19	4.2	6.1
Parker, Pa.	73	20	8.5	3,4	1.8	18-20	4.4	6.7
Freeport, Pa.	29	20	20.3	3	3.9	20	8.7	16.4
Springdale, Pa.	17	27	23.4	4	8.0	19,20	12.4	15.4
Cheat River.								
Rowlesburg, W. Va.	36	14	6.2	4	1.8	15,16	3.0	4.4
Youghiogheny River.								
Confluence, Pa.	59	10	6.6	3	1.0	20	2.1	5.6
West Newton, Pa.	15	25	12.7	3	1.1	20	3.5	11.6
Monongahela River.								
Weston, W. Va.	161	18	8.0	3	0.0	14,15	0.8	8.0
Fairmont, W. Va.	119	25	22.2	3	14.8	16,17	16.2	7.4
Greensboro, Pa.	81	18	17.8	3	7.5	14-18	9.4	10.3
Lock No. 4, Pa.	40	28	24.5	3	7.1	16-18	10.8	17.4
Beaver River.								
Ellwood Junction, Pa.	10	14	5.1	3	1.6	20,28	2.9	3.5
Muskingum River.								
Zanesville, Ohio	70	25	16.6	3	8.7	17,19	11.2	7.9
Beverly, Ohio.	20	25	16.9	3	5.7	17,18	8.8	11.2
Little Kanawha River.								
Glenville, W. Va	77	20	10.6	3	0.8	14,31	2.8	9.8
Creston, W. Va. (a)	38	20	14.5	4	3.2	14,15	4.9	11.3
New River.								
Radford, Va	155	14	4.0	22,24	— 0.4	1,2	1.3	4.4
Hinton, W. Va.	95	14	5.8	4	1.5	1,2	2.8	4.3
Great Kanawha River.								
Charleston, W. Va.	58	30	10.3	5	4.7	10,11	6.7	5.6
Scioto River.								
Columbus, Ohio	110	17	6.0	22	2.8	12,18-20	3.9	3.2
Licking River.								
Falmouth, Ky.	30	25	16.0	2	2.2	14,15	6.2	13.8
Miami River.								
Dayton, Ohio	77	18	3.8	23	1.3	17-20	2.2	2.5
Kentucky River.								
Jackson, Ky.	287	24	10.0	3	5.0	10-14,20,30,31	5.0	5.0
Beattyville, Ky	254	30	7.5	4	0.6	14	2.3	6.9
High Bridge, Ky.	117	17	15.5	4	10.2	15	12.3	5.3
Frankfort, Ky.	65	31	11.0	4	6.8	14,15	8.4	4.2
Wabash River.								
Terre Haute, Ind.	171	16	9.8	3	1.9	20,21	4.9	7.9
Mount Carmel, Ill	75	15	12.8	5	3.7	23	7.4	9.1
Cumberland River.								
Burnside, Ky.	518	50	22.2	4	4.3	31	9.2	17.9
Celina, Tenn.	383	45	20.4	6	7.9	21	13.6	12.5
Carthage, Tenn.	308	40	19.4	25	7.2	11	12.3	12.2
Nashville, Tenn.	193	40	24.8	24,25	11.9	12	18.2	12.9
Clarksville, Tenn.	126	42	27.3	25	7.3	6	19.1	20.0
Powell River.								
Tazewell, Tenn.	44	20	4.5	25	0.4	1,2	1.9	4.1
Clinch River.								
Speers Ferry, Va.	156	20	4.8	4	0.0	2	0.9	4.8
Clinton, Tenn	82	25	11.0	6	3.0	2	6.8	8.0
South Fork Holston River.								
Bluff City, Tenn.	35	15	3.2	4	0.3	2	1.3	2.9
Holston River.								
Rogersville, Tenn.	103	14	5.0	4	1.4	1,2	2.5	3.6
French Broad River.								
Asheville, N. C.	144	6	2.8	3,10	— 0.6	1,2	0.8	3.4
French Broad River—C't'd.								
Leadvale, Tenn.	70	15	4.0	4,10	— 2.0	2	1.6	6.0
Dandridge, Tenn	46	15	5.2	4	0.4	2	2.0	4.8
Little Tennessee River.								
McGhee, Tenn.	17	20	7.8	3	2.2	1	4.7	5.6
Hiwassee River.								
Charleston, Tenn	18	22	10.1	10	1.7	1,2	6.1	8.4
Tennessee River.								
Knoxville, Tenn.	635	29	7.0	4	0.4	1,2	3.0	6.6
Loudon, Tenn	590	25	6.6	4	0.8	1,2	3.3	5.8
Kingston, Tenn.	556	25	6.8	4	1.3	1,2	4.1	5.5
Chattanooga, Tenn.	452	33	11.0	25	1.5	1	7.2	9.5
Bridgeport, Ala.	402	24	9.1	26	0.5	1	5.6	8.6
Guntersville, Ala.	349	31	14.6	26	1.6	2	9.7	13.0
Florence, Ala.	255	16	9.3	27	0.3	1,2	5.9	9.0
Riverton, Ala.	225	26	14.8	25-27	1.5	1	9.7	13.3
Johnsonville, Tenn.	95	21	15.9	26	1.8	2	9.5	14.1
Ohio River.								
Pittsburg, Pa.	966	22	23.5	4	2.5	19	7.7	21.0
Davis Island Dam, Pa.	960	25	22.2	4	4.7	19	9.2	17.5
Beaver Dam, Pa	925	27	31.0	4	6.1	18	12.8	24.9
Wheeling, W. Va.	875	36	31.6	5	5.9	19, 20	12.9	25.7
Parkersburg, W. Va.	785	36	29.8	5	7.4	20, 21	14.2	22.4
Point Pleasant, W. Va.	703	39	34.2	6	8.1	20	16.6	26.1
Huntington, W. Va.	660	50	37.4	6	12.1	21	20.9	25.3
Catlettsburg, Ky.	651	50	38.2	6	11.9	21	21.1	26.3
Portsmouth, Ohio	612	50	38.7	6	13.5	15, 21	22.4	25.2
Maysville, Ky.	559	50	37.3	6, 7	13.7	15, 16	22.3	23.6
Cincinnati, Ohio.	499	50	40.0	7	16.0	16	25.6	24.0
Madison, Ind	413	46	32.7	7	14.7	16, 17	22.4	18.0
Louisville, Ky	367	28	13.8	8	6.6	17	9.4	7.2
Evansville, Ind.	184	35	32.0	9	14.7	19	22.9	17.3
Mount Vernon, Ind	148	35	31.0	9	13.4	19, 20	22.1	17.6
Paducah, Ky.	47	40	25.7	10	9.1	1	20.5	16.6
Cairo, Ill.	1	45	29.6	11	15.3	1	24.8	14.3
St. Francis River.								
Marked Tree, Ark.	104	17	12.6	30, 31	7.3	1	10.1	5.3
Neosho River.								
Neosho Rapids, Kans.	326	22	1.6	1	1.2	26-31	1.3	0.4
Iola, Kans.	262	10	0.8	1	0.2	5	0.4	0.6
Oswego, Kans.	184	20	1.5	1	0.6	11-13,19-21,26-28	0.8	0.9
Fort Gibson, Ind. T	3	22	11.0	1	9.6	26	10.2	1.4
Canadian River.								
Calvin, Ind. T	99	10	4.2	1	2.0	9	2.9	2.2
Black River.								
Blackrock, Ark.	67	12	10.4	3, 4	3.8	1	7.1	6.6
White River.								
Calicorock, Ark	272	15	7.1	3	1.4	29	3.0	5.7
Batesville, Ark.	217	18	9.4	3	3.6	29	5.3	5.8
Newport, Ark.	185	26	13.7	5	5.0	1	8.2	8.7
Clarendon, Ark.	75	30	22.9	11, 12	15.1	1	21.3	7.8
Arkansas River.								
Wichita, Kans.	832	10	0.4	1, 2	— 0.4	20,21,24,31	—0.2	0.8
Tulsa, Ind. T.	551	16	3.4	2, 3	2.7	20,21,30,31	2.9	0.7
Webbers Falls, Ind. T	465	23	6.8	1	5.4	22, 23	5.8	1.4
Fort Smith, Ark.	403	22	6.8	23	2.4	21	4.6	4.4
Dardanelle, Ark.	256	21	8.4	3	3.3	18, 20	5.0	5.1
Little Rock, Ark.	176	23	11.2	4	5.3	19	7.5	5.9
Yazoo River.								
Greenwood, Miss	175	38	15.8	25, 26	1.7	3-6	8.0	14.1
Yazoo City, Miss.	80	25	10.7	28, 29	— 1.4	5-10	4.5	12.1
Ouachita River.								
Camden, Ark.	304	39	39.5	27	13.5	15	22.2	17.0
Monroe, La	122	40	25.6	31	14.1	6	20.5	11.5
Red River								
Arthur City, Tex.	688	27	17.2	15	6.5	13	10.2	10.7
Fulton, Ark.	515	28	26.4	24	11.2	13	19.9	15.2
Shreveport, La.	327	29	22.1	31	9.0	14, 15	14.4	13.1
Alexandria, La.	118	33	27.3	31	9.6	1	17.7	17.7
Mississippi River.								
St. Cloud, Minn. (31)	2,034	4	.....	.....	.....	.....	.....	.....
St. Paul, Minn. (10)	1,954	14	9.2	26	6.3	23	7.1	2.9
Red Wing, Minn. (31)	1,914	14	.....	.....	.....	.....	.....	.....
Reeds Landing, Minn. (7)	1,884	12	3.7	1, 12, 13	2.8	5, 6	3.3	0.9
La Crosse, Wis. (5)	1,819	12	7.5	26	4.3	7-9	4.9	3.2
Prairie du Chien, Wis. (16)	1,759	18	5.8	15	4.2	9	4.8	1.6
Dubuque, Iowa. (13)	1,699	18	8.7	13, 14	5.0	4	7.3	3.7
Clinton, Iowa. (22)	1,629	16	.....	.....	.....	.....	.....	.....
Leclaire, Iowa. (7)	1,609	10	3.2	1	1.0	10,11,20-24	1.5	2.2
Davenport, Iowa	1,593	15	4.7	1	2.7	6	3.8	2.0
Muscatine, Iowa	1,562	16	5.7	1	3.9	7, 8	4.6	1.8
Galland, Iowa	1,472	8	3.4	1	1.5	10	2.3	1.9
Keokuk, Iowa.	1,463	15	4.8	2	2.5	10, 11	3.2	2.3
Warsaw, Ill. (2)	1,458	18	7.8	2	5.6	9	6.2	2.2
Hannibal, Mo	1,402	13	5.8	1-3	3.5	12, 13	4.3	2.3
Grafton, Ill	1,306	23	7.5	3, 4	5.5	27, 28	6.2	2.0
St. Louis, Mo	1,264	30	10.8	2	5.4	13, 27, 28	6.9	5.4
Chester, Ill	1,189	30	9.7	3	5.1	14,15,19,28	6.4	4.6
Cape Girardeau, Mo.	1,128	28	14.4	3, 4	9.7	19, 20	11.1	4.7
New Madrid, Mo.	1,003	34	24.2	11	11.6	1	20.0	12.6
Luxora, Ark	905	33	17.2	12	5.5	1	12.8	11.7
Memphis, Tenn	843	33	21.0	13	7.4	1	16.1	13.6
Helena, Ark.	767	42	28.0	15	11.8	1, 2	22.0	16.2
Arkansas City, Ark.	635	42	30.8	16	15.2	2, 3	25.2	15.6
Greenville, Miss.	595	42	25.8	16, 17	11.9	2, 3	20.7	13.9
Vicksburg, Miss.	474	45	28.0	18	11.9	4	21.7	16.1
Natchez, Miss.	373	46	29.0	20	14.8	5	23.2	14.2
Baton Rouge, La. (b)	240	35	21.8	20	9.7	6	16.6	12.1
Donaldsonville, La	188	28	16.4	20	6.6	6	12.2	9.8
New Orleans, La.	108	16	10.5	20	4.7	6	8.0	5.8
Atchafalaya River.								
Simmesport, La.	127	33	25.7	22, 23	13.4	6	20.7	12.3

TABLE VI.—*Heights of rivers referred to zeros of gages*—Continued.

Stations.	Distance to mouth of river.	Danger line on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Atchafalaya River—Cont'd.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Melville, La.	103	31	27.7	22-24	17.2	5,6	23.5	10.5
Morgan City, La	19	8	4.5	28	2.0	4	3.6	2.5
Grand River.								
Grand Rapids, Mich.	38	11	2.4	2,30	1.6	15,26	2.0	0.8
Penobscot River.								
Mattawamkeag, Me. (31)	87	..	.....	.....	.....	.....	.....	.....
West Enfield, Me. (21)	60	..	3.2	1	1.8	3	2.6	1.4
Kennebec River.								
Winslow, Me	46	.....	4.6	5	1.5	18	3.5	3.1
Merrimac River.								
Franklin Junction, N. H. (c)	110	.....	8.1	4	4.2	24	4.9	3.9
Concord, N. H. (19)	94	.....	3.9	5,11	1.0	2	2.6	2.9
Manchester, N. H	68	.....	4.3	4,5,31	2.0	11	3.4	2.3
Connecticut River.								
Wells River, Vt. (31)	255	.....	.....	.....	.....	.....	.....	.....
Whiteriver Junction, Vt.	209	.....	8.8	5	5.8	13,20-22, 26-29	6.4	3.0
Bellows Falls, Vt.	170	12	4.6	4	2.1	11	2.8	2.5
Holyoke, Mass	84	9	5.2	4	1.1	29	2.5	4.1
Hartford, Conn.	50	13	10.5	5	3.3	15	5.2	7.2
Housatonic River.								
Gaylordsville, Conn.	44	15	6.5	4	4.2	17	5.0	2.3
Mohawk River.								
Utica, N. Y.	98	6	9.5	3	1.7	19	4.7	7.8
Tribeshill, N. Y.	42	12	7.6	4	1.0	12-21,27,29	2.2	6.6
Schenectady, N. Y.	19	15	10.5	4	1.1	21	2.9	9.4
Hudson River.								
Glens Falls, N. Y.	197	8	5.1	2	3.8	17-20	4.5	1.3
Troy, N. Y.	154	14	7.0	4	3.3	30	5.0	3.7
Albany, N. Y.	147	12	10.5	4	2.2	20	4.3	8.3
Stuyvesant, N. Y.	128	9	3.6	3,4	0.5	24	2.1	3.1
Pompton River.								
Pompton Plains, N. J.	6	8	4.9	22	4.3	1-20	4.4	0.6
Passaic River.								
Chatham, N. J	69	7	4.1	23	2.2	20	3.2	1.9
Lehigh River.								
Mauchchunk, Pa	45	15	7.2	4	4.5	19,20	5.0	2.7
Schuylkill River.								
Reading, Pa.	66	12	4.9	4	0.9	16-20	1.6	4.0
Delaware River.								
Hancock (E. Branch), N. Y	269	12	9.3	4	3.5	16,18,20,21	4.3	5.8
Hancock (W. Branch), N. Y.	269	10	8.2	4	3.5	16,17,28	4.5	4.7
Port Jervis, N. Y.	204	14	8.4	4	1.0	18,19	2.4	7.4
Phillipsburg, N. J. (4)	142	26	10.7	4	2.3	20	4.4	8.4
Trenton, N. J.	92	18	7.0	5	2.1	21	3.3	4.9
North Branch Susquehanna.								
Binghamton, N. Y.	183	16	11.6	4	2.8	17,19,20	4.4	8.8
Towanda, Pa	139	16	10.5	4	1.8	18-20	4.0	8.7
Wilkes-Barre, Pa.	60	17	16.0	5	4.6	19	7.9	11.4
West Branch Susquehanna.								
Clearfield, Pa.	165	8	6.2	4	1.3	15-20	2.4	4.9
Renovo, Pa.	90	16	11.3	4	1.1	20	4.1	10.2
Williamsport, Pa.	39	20	16.8	4	2.0	17	5.5	14.8
Juniata River.								
Huntingdon, Pa.	90	24	7.2	3	3.5	16,18-20	4.4	3.7
Susquehanna River.								
Selinsgrove, Pa.	116	17	10.2	5	1.8	20	4.1	8.4
Harrisburg, Pa.	69	17	12.4	5	2.4	20	5.2	10.0
Shenandoah River.								
Riverton, Va.	58	22	2.0	21	— 0.5	1-20,31	—0.2	2.5
Potomac River.								
Cumberland, Md.	290	8	4.6	4	2.8	12-20	3.6	1.8
Harpers Ferry, W. Va.	172	18	9.8	23	0.0	1,20	3.2	9.8
James River.								
Buchanan, Va.	305	12	7.1	22	1.9	1,2	3.5	5.2
Lynchburg, Va.	260	18	5.0	22	0.0	1,2	1.9	5.0
Columbia, Va.	167	18	15.8	22	2.5	1,2	5.8	13.3
Richmond, Va.	111	12	8.3	22	— 0.2	2	1.3	8.5
Dan River.								
Danville, Va.	55	8	5.0	21	— 0.3	1,2	1.0	5.3
Roanoke River.								
Clarksville, Va	196	12	9.8	23	— 0.5	1,2	2.4	10.3
Weldon, N. C.	129	30	34.4	24	8.7	1,2	15.4	25.7
Tar River.								
Tarboro, N. C.	46	25	13.8	25	1.4	1,2	6.6	12.4
Greenville, N. C.	21	22	12.2	26	3.2	1-3	7.4	9.0
Haw River.								
Moncure, N. C.	171	25	17.5	29	3.5	2	9.4	14.0
Cape Fear River.								
Fayetteville, N. C.	112	38	34.0	30	3.4	2	12.4	30.6
Waccamaw River.								
Conway, S. C.	40	7	4.2	29-31	1.0	1	2.9	3.2
Pedee River.								
Cheraw, S. C	149	27	29.7	23	1.5	1,2	9.8	28.2
Smiths Mills, S. C.	51	16	14.7	31	1.5	1,2	9.1	13.2
Lynch Creek.								
Effingham, S. C.	35	12	11.0	31	3.3	1,2	7.7	7.7
Black River.								
Kingstree, S. C.	45	12	7.0	31	2.2	1,2	4.2	4.8
Catawba River.								
Mount Holly, N. C.	28	15	4.0	22	1.5	2	2.7	2.5
Wateree River.								
Camden, S. C.	37	24	28.3	22	4.2	2	11.3	24.1
Broad River.								
Blairs, S. C	36	14	15.0	22	0.4	2	3.4	14.6
Saluda River.								
Chappels, S. C.	56	14	18.6	22	1.6	2	6.4	17.0

Stations.	Distance to mouth of river.	Danger line on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Congaree River.	*Miles*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Columbia, S. C	52	15	20.0	22	1.0	1,2	4.6	19.0
Santee River.								
St. Stephens, S. C.	50	12	11.5	30	— 0.8	2	7.0	12.3
Edisto River.								
Edisto, S. C.	75	6	4.8	28	1.3	1-3	3.4	3.5
Broad River.								
Carlton, Ga.	30	11	9.8	3	1.7	1,2	3.9	8.1
Savannah River.								
Calhoun Falls, S. C.	347	15	8.0	4	2.7	1,2	4.1	5.3
Augusta, Ga.	268	32	28.3	22	6.0	1,2	13.1	22.3
Oconee River.								
Milledgeville, Ga.	147	25	18.8	21	1.1	2	7.1	17.7
Dublin, Ga	79	30	14.6	26	— 0.4	2	6.5	15.0
Ocmulgee River.								
Macon, Ga.	203	18	16.7	21	0.8	1,2	7.6	15.9
Abbeville, Ga.	96	11	12.9	29	0.9	2	7.5	12.0
Flint River.								
Woodbury, Ga.	227	10	5.4	22	0.3	2	2.6	5.1
Montezuma, Ga.	152	20	13.9	25	2.3	2	7.9	11.6
Albany, Ga.	90	20	13.6	28	0.7	2	6.9	12.9
Bainbridge, Ga	29	22	14.2	29,30	2.8	1,2	8.0	11.4
Chattahoochee River.								
Oakdale, Ga	305	18	13.9	4	0.8	1	4.4	13.1
West Point, Ga	239	20	14.2	4	1.9	2	5.8	12.3
Eufaula, Ala	90	40	30.0	22	1.2	1,2	12.6	28.8
Alaga, Ala. (5)	30	25	25.3	23	2.1	1	11.7	23.2
Coosa River.								
Rome, Ga.	271	30	18.0	10	0.5	1,2	7.3	17.5
Gadsden, Ala.	144	22	16.0	12	0.7	1,2	9.5	15.3
Lock No. 4, Ala.	116	17	12.4	24	0.9	2	7.8	11.5
Wetumpka, Ala	6	45	25.5	24	2.1	1	15.8	23.4
Tallapoosa River.								
Milstead, Ala.	38	35	22.3	4	1.8	1	8.9	20.5
Alabama River.								
Montgomery, Ala.	265	35	24.0	25	0.1	1	13.3	23.9
Selma, Ala	212	35	25.4	26	0.0	1	15.0	25.4
Black Warrior River.								
Tuscaloosa, Ala.	90	43	22.6	25	5.7	1	12.8	16.9
Tombigbee River.								
Columbus, Miss. (8)	303	33	7.1	21,22	— 2.2	1	2.7	9.3
Vienna, Ala.	233	42	11.6	23	1.1	1	6.4	10.5
Demopolis, Ala.	155	35	22.8	26	0.5	1	11.5	22.3
Leaf River.								
Hattiesburg, Miss	60	20	8.5	3	2.9	2	5.2	5.6
Chickasawhay River.								
Enterprise, Miss	144	18	4.5	31	1.5	10-13	2.6	3.0
Shubuta, Miss.	106	25	12.0	30	3.0	8,9	6.7	9.0
Pascagoula River.								
Merrill, Miss.	78	20	12.5	31	1.7	1	6.8	10.8
Pearl River.								
Jackson, Miss	242	20	8.2	23	1.8	1, 2, 4, 5, 7, 8	4.6	6.4
Columbia, Miss.	110	14	10.5	22	4.9	1, 5-7, 11-13	7.2	5.6
Sabine River.								
Logansport, La.	315	25	26.3	26	7.0	1	16.9	19.3
Neches River.								
Rockland, Tex	105	20	11.5	31	2.2	1	6.2	9.3
Beaumont, Tex.	18	10	3.1	29	0.7	11	1.5	2.4
Trinity River.								
Dallas, Tex.	320	25	27.3	16	3.8	11	10.6	23.5
Long Lake, Tex.	211	35	39.7	27,28	6.0	9-11	21.9	33.7
Riverside, Tex.	112	40	25.9	31	2.8	12,13	13.0	23.1
Liberty, Tex	20	25	23.3	28-31	7.1	9	10.3	16.2
Brazos River.								
Kopperl, Tex.	345	21	0.6	18-25	— 0.2	1-12	0.2	0.8
Waco, Tex.	285	24	5.1	21	2.7	11,12	3.7	2.4
Valley Junction, Tex.	215	40	8.8	21	1.8	9-12	4.0	7.0
Hempstead, Tex	140	40	14.5	24	0.0	12	5.5	14.5
Booth, Tex	61	39	6.8	22	4.4	10	5.5	2.4
Colorado River.								
Ballinger, Tex.	489	21	2.0	20,21	1.7	1-6,8-11, 28-31	17.7	0.3
Austin, Tex.	214	18	1.8	21-23	1.2	1-8	1.4	0.6
Columbus, Tex.	98	24	8.5	20	6.5	7-9	7.2	2.0
Guadalupe River.								
Gonzales, Tex.	112	22	1.2	20	0.7	25, 26, 29, 30	0.8	0.5
Victoria, Tex	35	16	2.6	16	1.4	11	2.0	1.2
Red River of the North.								
Moorhead, Minn. (31)	284	26	.....	.....	.....	.....	.....	.....
Kootenai River.								
Bonners Ferry, Idaho. (31)	123	24	.....	.....	.....	.....	.....	.....
Pend d'Oreille River.								
Newport, Wash.	86	14	— 0.9	1	— 1.5	31	—1.2	0.6
Snake River.								
Lewiston, Idaho	144	24	1.3	6,7	0.3	16	0.9	1.0
Riparia, Wash.	67	30	1.9	1-4	1.4	16	1.6	0.5
Columbia River.								
Wenatchee, Wash	473	40	7.0	1	3.7	31	5.7	3.3
Umatilla, Oreg.	270	25	2.9	1	1.7	28	2.2	1.2
The Dalles, Oreg.	166	40	1.7	1	— 0.1	16	0.5	1.8
Willamette River.								
Albany, Oreg.	118	20	7.2	31	2.8	16,17	4.4	4.4
Salem, Oreg	84	20	6.8	31	2.0	16	4.1	4.8
Portland, Oreg.	12	15	5.6	28	1.9	1	3.5	3.7
Sacramento River.								
Red Bluff, Cal.	201	23	1.3	20	0.6	2-16,23-27	0.7	0.7
Sacramento, Cal.	64	25	7.8	22	6.9	11-18	7.2	0.9

Figures after names of stations indicate number of days frozen. (a) 30 days only. (b) 28 days only. (c) 27 days only.

Honolulu, T. H., latitude, 21° 19′ north, longitude 157° 52′ west; barometer above sea, 38 feet; gravity correction, —.057 applied. December, 1905.

Day.	Pressure.*		Air temperature.				Moisture.				Wind.				Precipitation.		Clouds.					
							8 a. m.		8 p. m.		8 a. m.		8 p. m.				8 a. m.			8 p. m.		
	8 a. m.	8 p. m.	8 a. m.	8 p. m.	Maximum.	Minimum.	Wet.	Relative humidity.	Wet.	Relative humidity.	Direction.	Velocity.	Direction.	Velocity.	8 a. m.	8 p. m.	Amount.	Kind.	Direction.	Amount.	Kind.	Direction.
1	30.02	30.03	74.0	73.3	77	70	68.9	78	67.3	73	ne.	4	ne.	7	T.	0.02	3 4	Cu. S.-cu.	e. e.	3	S.-cu.	e.
2	30.07	30.08	74.1	75.0	80	70	68.0	73	68.2	71	e.	6	e.	8	0.03	T.	3 4	Cu. S.-cu.	e. e.	5	Cu.	e.
3	30.10	30.06	74.7	72.1	79	69	66.2	64	67.6	79	ne.	7	e.	2	T.	T.	4	Cu.	e.	4 5	S.-cu. N.	e. e.
4	30.06	30.02	74.5	72.0	77	68	67.0	68	64.4	67	ne.	8	s.	4	T.	0.00	2	Cu.	e.	few.	Cu.	e.
5	30.04	30.03	70.0	71.4	79	63	64.8	76	63.5	65	e.	4	sw.	3	0.00	0.00	few.	S.-cu.	0	few.	Cu.	e.
6	30.06	30.03	72.5	72.6	78	67	64.4	65	64.3	64	ne.	2	ne.	6	0.00	0.00	3 1	Cu. S. cu.	e. e.	1	S.-cu.	0
7	30.04	29.98	70.5	73.2	79	68	66.3	80	67.0	72	se.	5	ne.	2	0.00	0.01	9	S.-cu.	e.	10	S.-cu.	e.
8	29.98	29.88	69.7	71.9	81	66	65.2	79	66.4	73	sw.	8	e.	2	0.01	T.	3 7	S.-cu. N.	0 0	6 2	A.-Cu. S.-cu.	w. ?
9	29.89	29.96	71.3	66.0	72	63	66.3	77	57.5	59	nw.	5	w.	9	0.63	0.00	10	S.-cu.	w.	1 1	Ci.-s. S.-cu.	w. nw.
10	29.99	29.99	65.0	67.2	70	60	58.1	66	58.0	57	n.	6	ne.	12	0.01	T.	9	S.-cu.	n.	4	S.-cu.	n.
11	30.02	30.02	68.1	69.0	72	64	59.6	60	59.1	55	n.	8	ne.	8	T.	T.	3 2	Cu. S.-cu.	ne. ne.	2 5	Cu. S.-cu.	ne. ne.
12	30.05	30.04	66.5	70.0	72	62	61.8	77	61.2	60	ne.	5	ne.	13	0.04	0.01	7	N.	ne.	5 2	Cu. S.-cu.	e. e.
13	30.08	30.07	73.0	71.8	73	66	62.2	54	62.8	61	ne.	7	ne.	15	0.01	0.10	8	S.-cu.	e.	9	S.-cu.	e.
14	30.06	30.05	72.8	70.1	76	66	63.4	59	65.4	78	e.	11	ne.	4	0.01	0.10	3 1	Cu. S.-cu.	e. e.	10	N.	?
15	30.06	30.05	71.7	71.0	75	68	63.0	62	63.8	67	e.	6	e.	5	0.00	0.00	2 4	Cu. S.-cu.	e. e.	6	S.-cu.	e.
16	30.10	30.08	68.2	70.5	76	65	65.0	84	65.2	76	ne.	4	ne.	10	T.	0.01	4 5	S.-cu. N.	0 0	10	N.	ne.
17	30.09	30.07	72.3	71.0	77	68	66.3	73	65.0	72	ne.	3	ne.	7	0.02	0.00	7	S.-cu.	e.	4	S.-cu.	e.
18	30.09	30.03	71.3	70.2	77	66	64.1	68	66.7	83	ne.	5	ne.	8	0.01	0.01	1 2	Ci.-cu. S.-cu.	w. e.	9	S.-cu	e.
19	30.06	30.02	67.2	71.6	75	65	66.7	97	66.5	77	e	2	ne.	2	1.49	0.04	10	N.	e.	4	S.-cu.	e.
20	30.05	30.04	72.5	70.3	78	66	67.0	75	66.8	83	ne.	1	n.	4	0.00	T.	few.	S.-cu.	0	2	S.-cu.	0
21	30.09	30.13	72.5	72.3	78	66	67.0	75	67.2	76	n.	5	ne.	5	0.00	0.00	few.	S.-cu.	ne.	1	S.-cu.	e
22	30.19	30.18	73.5	72.2	77	69	66.2	68	64.5	66	ne.	7	ne.	6	0.01	0.00	1	S.-cu.	0	3	S.-cu.	e.
23	30.20	30.14	72.5	72.2	76	67	65.0	67	63.2	61	ne.	5	ne.	7	0.01	T.	7	S.-cu.	e.	2	S.-cu.	e.
24	30.16	30.13	72.0	71.5	75	67	62.9	61	63.7	65	e.	6	ne.	16	0.00	0.00	2	S.-cu.	e.	5	S.-cu.	e.
25	30.12	30.05	73.5	74.0	79	68	66.5	69	66.0	65	ne.	5	ne.	16	T.	0.01	1 6	Cu. S.-cu.	e. e.	5	S.-cu.	e.
26	30.08	30.06	75.0	74.3	79	72	67.0	66	68.0	72	e.	14	ne.	6	T.	T.	1 1	Cu. S.-cu.	e. e.	5	S.-cu.	e.
27	30.09	30.09	75.2	74.9	79	70	69.2	74	67.0	66	e.	5	e.	11	0.01	0.01	4	S.-cu.	e.	4	S.-cu.	?
28	30.10	30.09	77.0	73.2	79	72	68.0	63	68.2	78	ne.	5	ne.	6	0.00	0.02	1 1	Cu. S.-cu.	e. e.	5 5	S.-cu. N.	e. 0
29	30.08	30.05	75.0	73.9	78	70	67.2	67	65.8	65	ne.	12	ne.	12	0.03	T.	1 3	S.-cu. N.	e. e.	1 4	S.-cu. N.	e. e.
30	30.08	30.05	74.8	73.5	78	69	66.4	64	66.2	68	ne.	9	ne.	11	0.01	0.01	2	S.-cu.	e.	2	S.-cu.	e.
31	30.11	30.07	73.7	73.0	76	67	66.5	68	66.5	71	ne.	6	e.	11	0.06	0.03	4	S.-cu.	e.	2	S.-cu.	e.
Mean	30.071	30.051	72.1	71.8	76.7	67.0	65.4	70.2	64.9	69.3	ne.	6.0	ne.	7.7	2.47	0.38	5.0	S.-cu.	e.	5.0	S.-cu.	e.

Observations are made at 8 a. m. and 8 p. m., local standard time, which is that of 157° 30′ west, and is 5h and 30m slower than 75th meridian time. *Pressure values are reduced to sea level and standard gravity.

RAINFALL IN JAMAICA.

Through the kindness of Mr. H. H. Cousins, chemist to the government of Jamaica and now in charge of the meteorological service of that island, we have received the following table.

The rainfall for December was therefore above the average for the whole island. The greatest fall, 29.64 inches, occurred at Fellowship, in the northeastern division, while the least, 0.42 inch, was recorded at Pedro Plains, in the southern division.

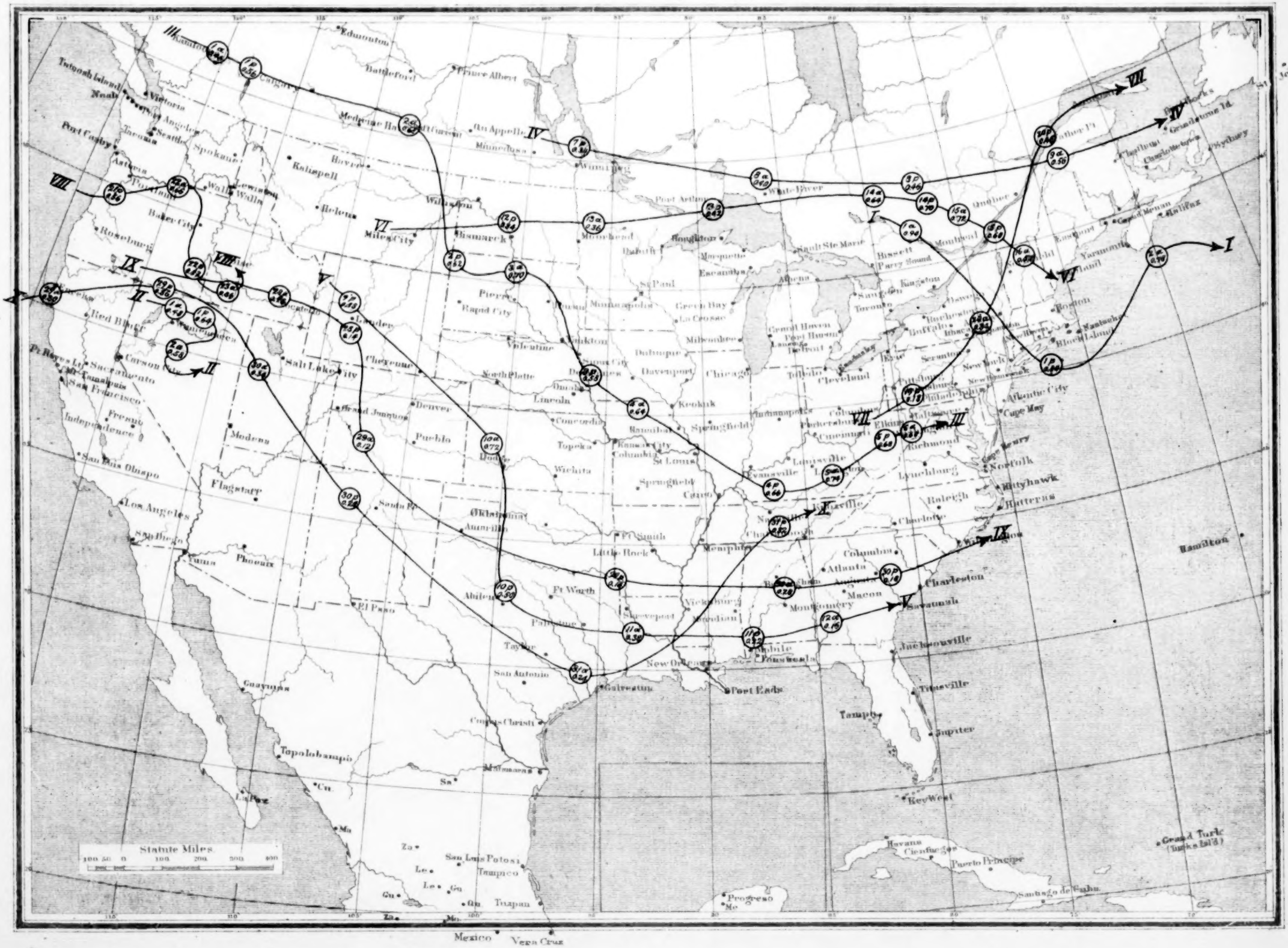
Comparative table of rainfall.

[Based upon the average stations only.]

DECEMBER, 1905.

Divisions.	Relative area.	Number of stations.	Rainfall.	
			1905.	Average.
	Per cent.		*Inches.*	*Inches.*
Northeastern division	25	23	12.27	11.03
Northern division	22	48	6.14	5.88
West-central division	26	22	5.24	3.55
Southern division	27	35	5.02	2.71
Means	100		7.17	5.79

Chart I. Tracks of Centers of High Areas, December, 1905.



• Barkerville

Chart II. Tracks of Centers of Low Areas, December, 1905.

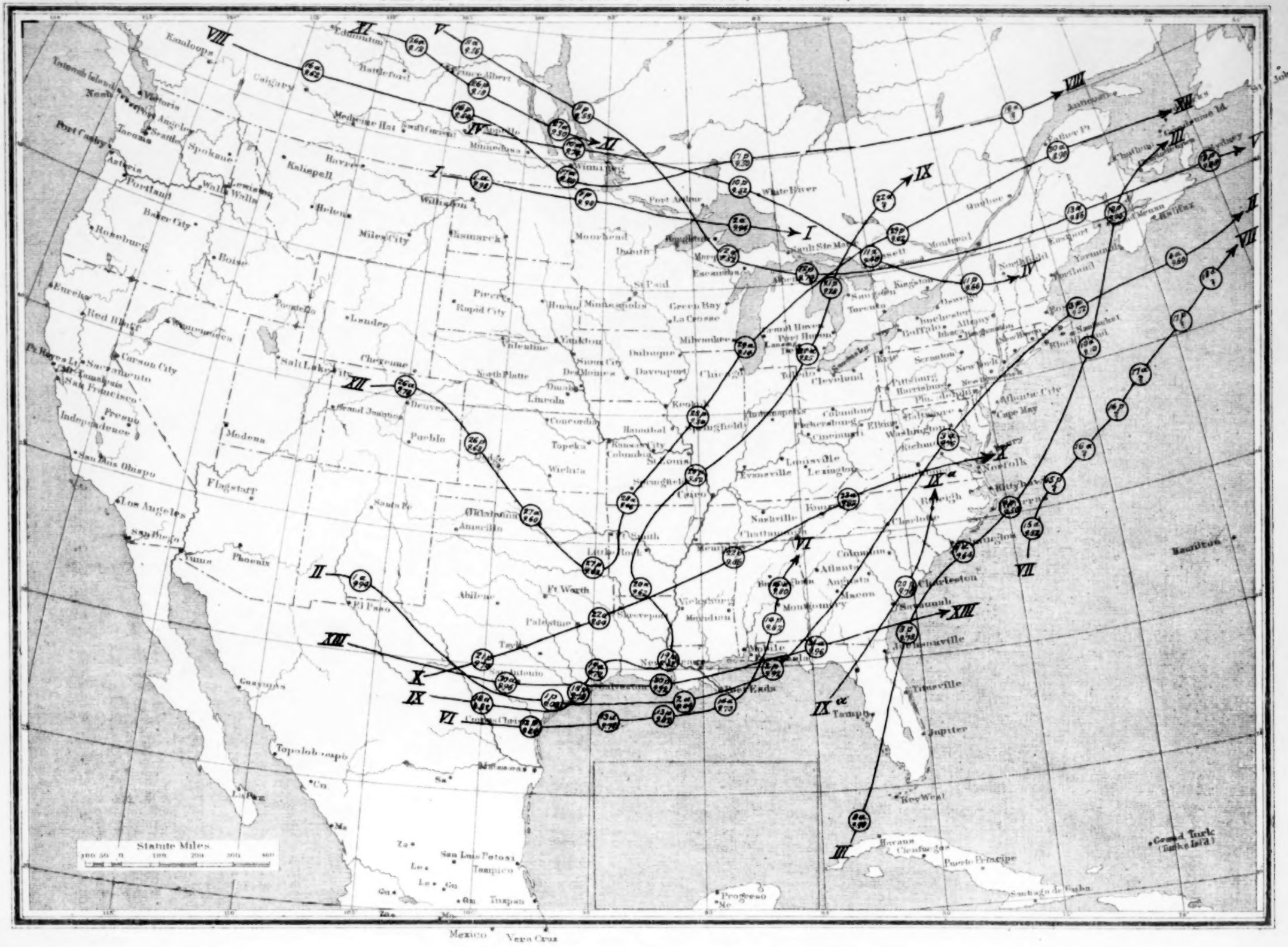


Chart III. Total Precipitation, December, 1905.

Chart III. Total Precipitation, December, 1905.

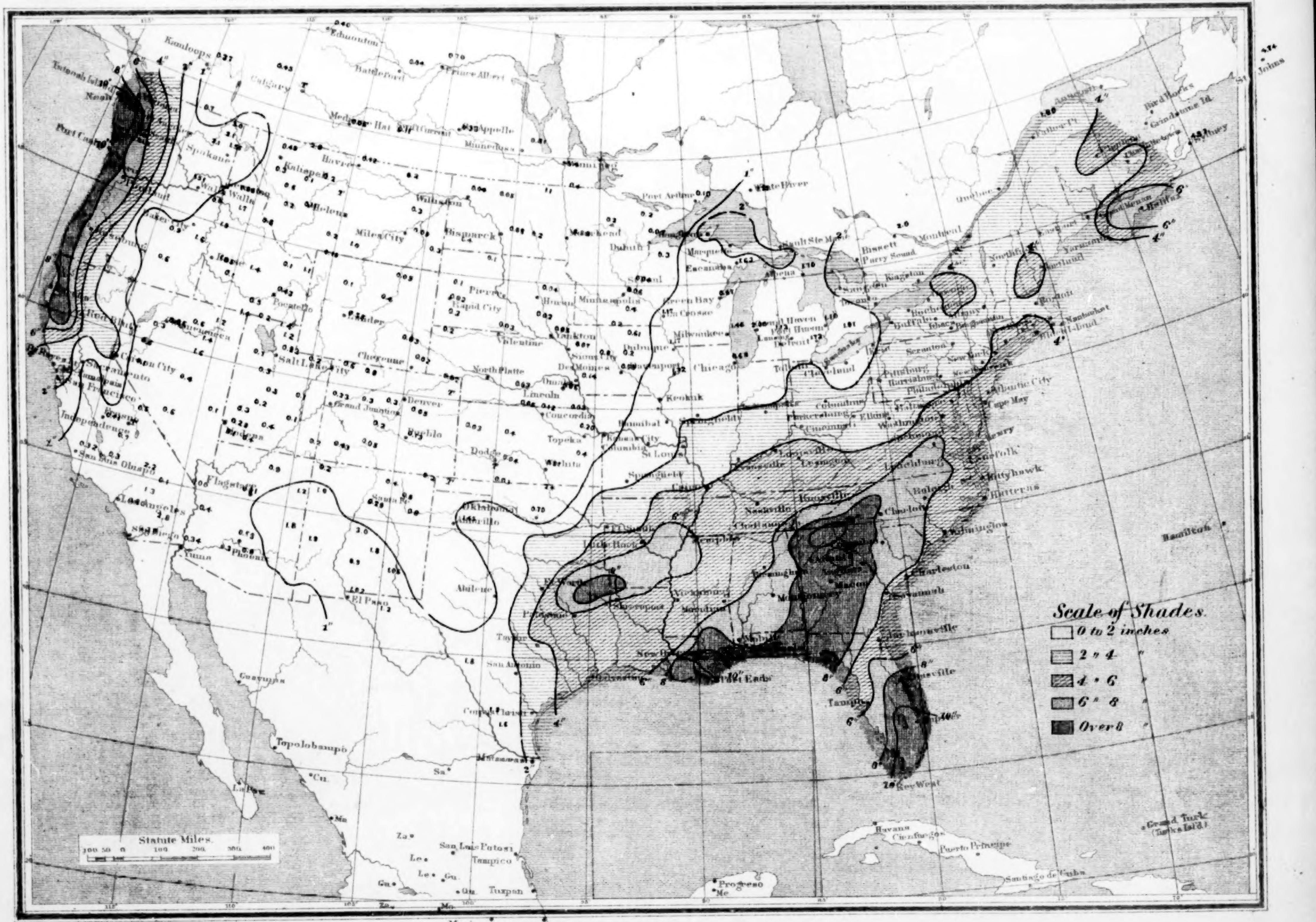


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Chart IV. Percentage of Clear Sky, December, 1905.

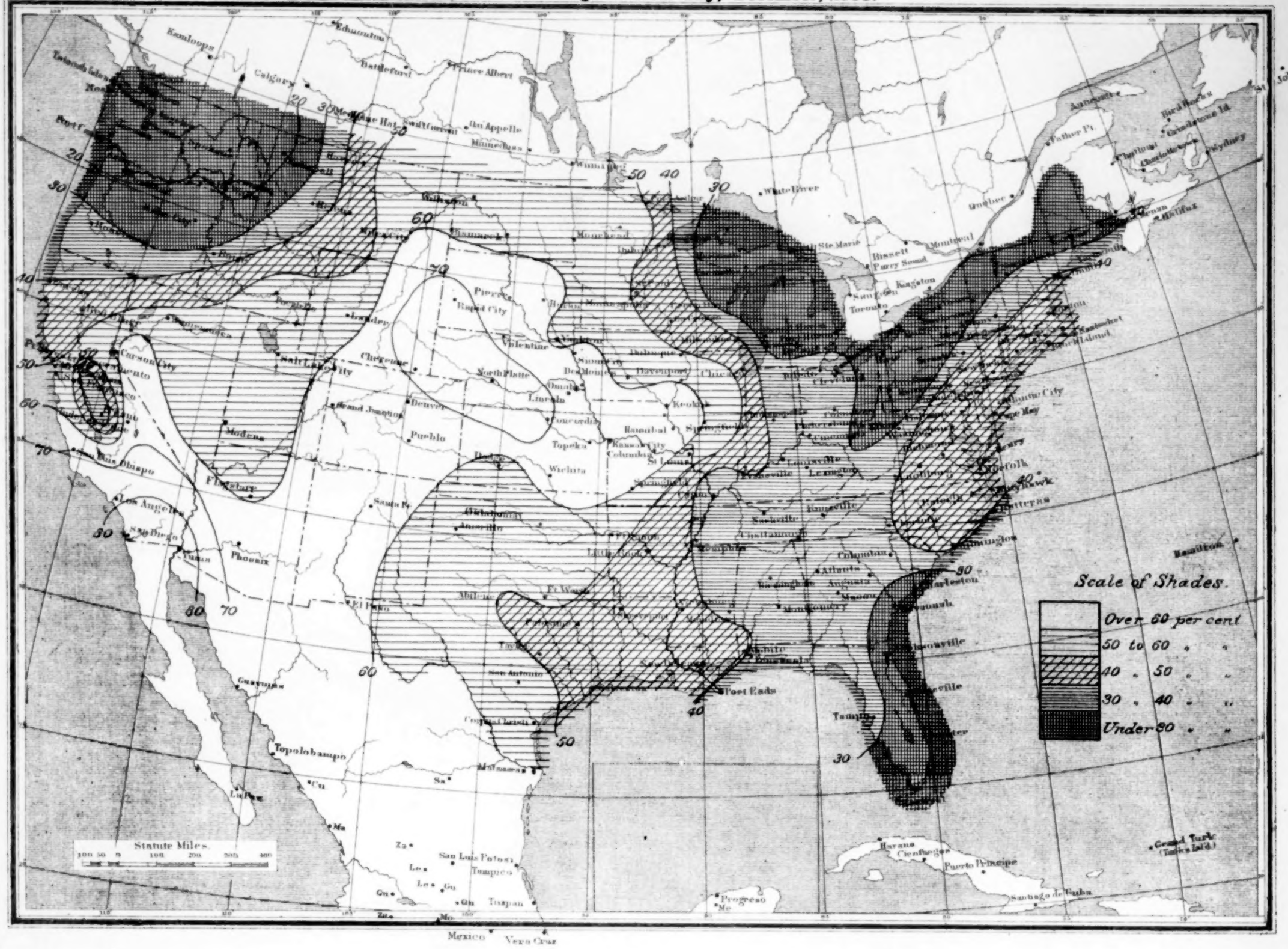


Chart V. Hydrographs for Seven Principal Rivers of the United States, December, 1905.

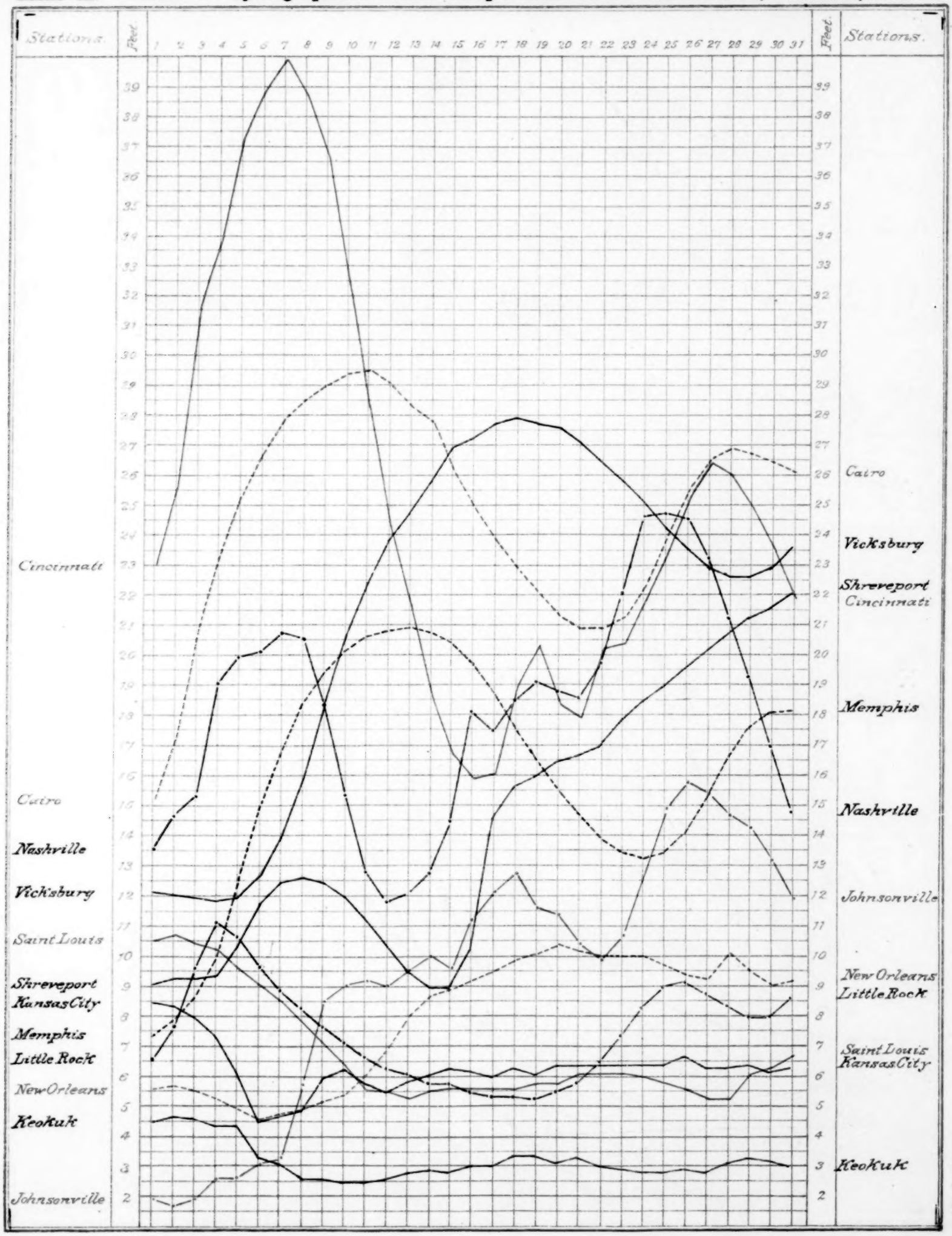

Stations.
Feet.
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
39 38 37 36 35 34 33 32 31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2
Cincinnati
Cairo
Nashville
Vicksburg
Saint Louis
Shreveport
Kansas City
Memphis
Little Rock
New Orleans
Keokuk
Johnsonville
Feet.
Stations.
99 38 37 36 35 34 33 32 31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2
Cairo
Vicksburg
Shreveport
Cincinnati
Memphis
Nashville
Johnsonville
New Orleans
Little Rock
Saint Louis
Kansas City
Keokuk

Chart VI. Isobars and Isotherms at 10,000 feet, December, 1905.

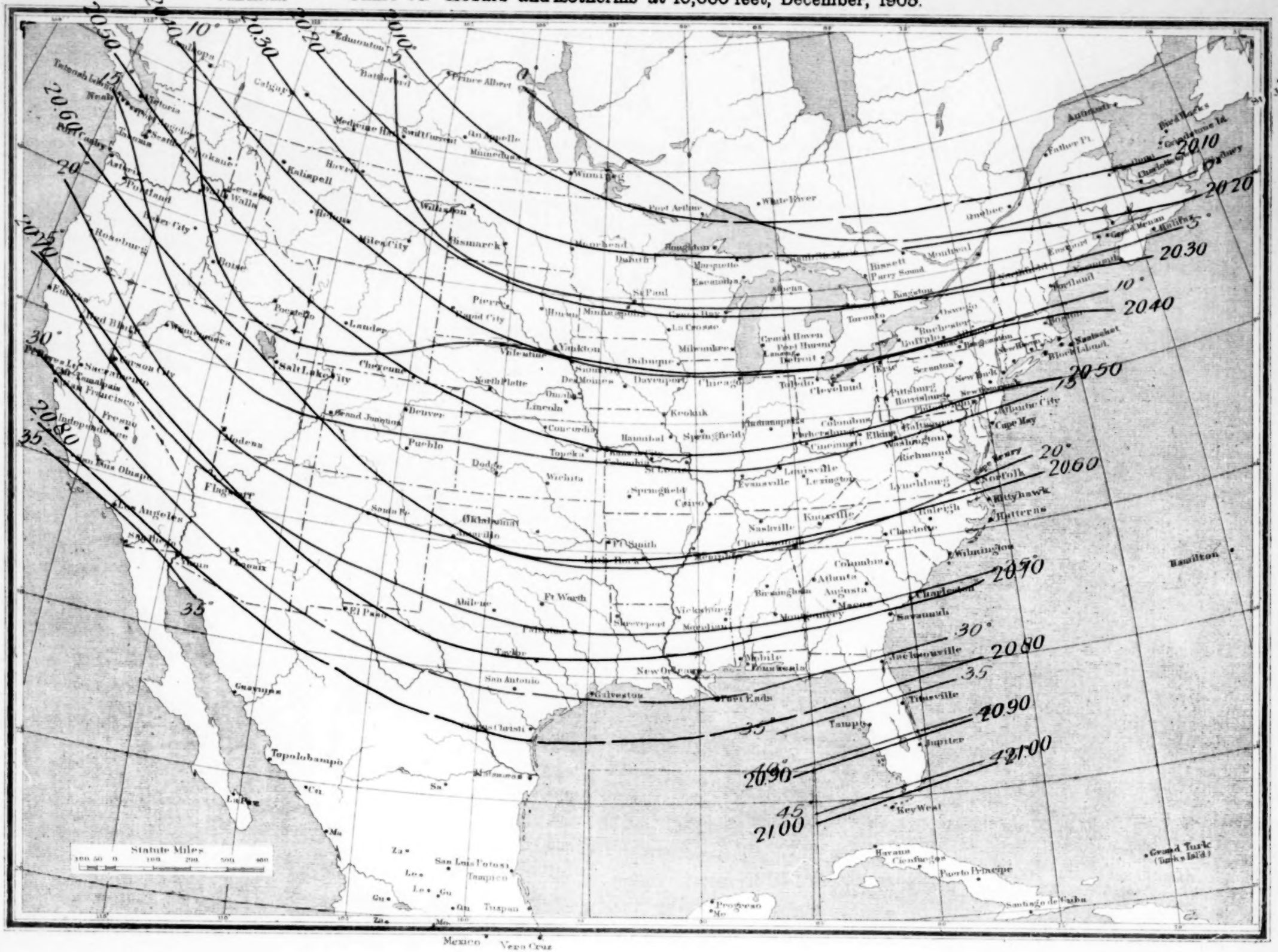


Chart VII. Isobars and Isotherms at 3500 feet, December, 1905.

Chart VII. Isobars and Isotherms at 3500 feet, December, 1905.

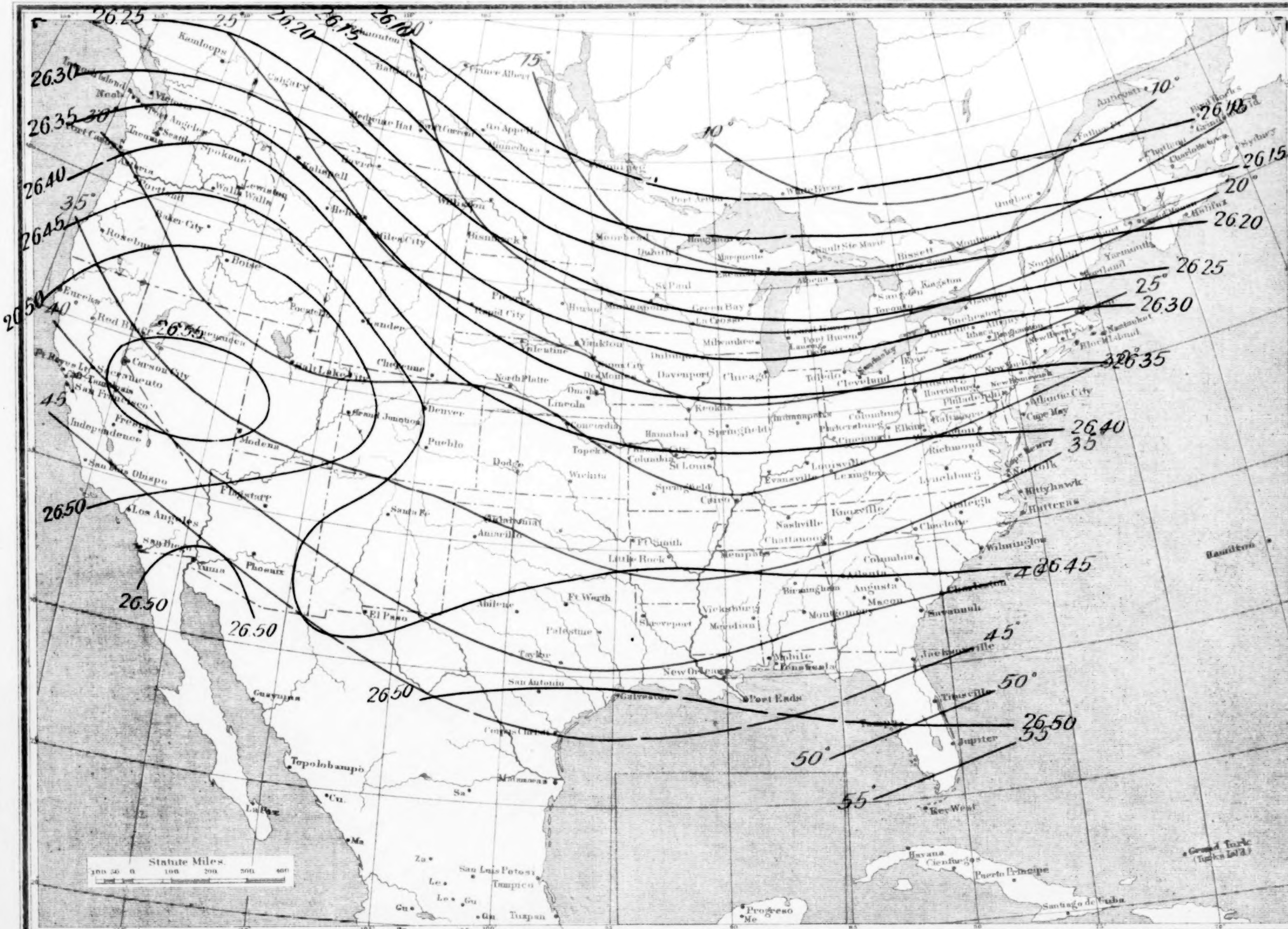


Chart VIII. Isobars and Isotherms at Sea Level; Surface Wind Resultants, December, 1905.

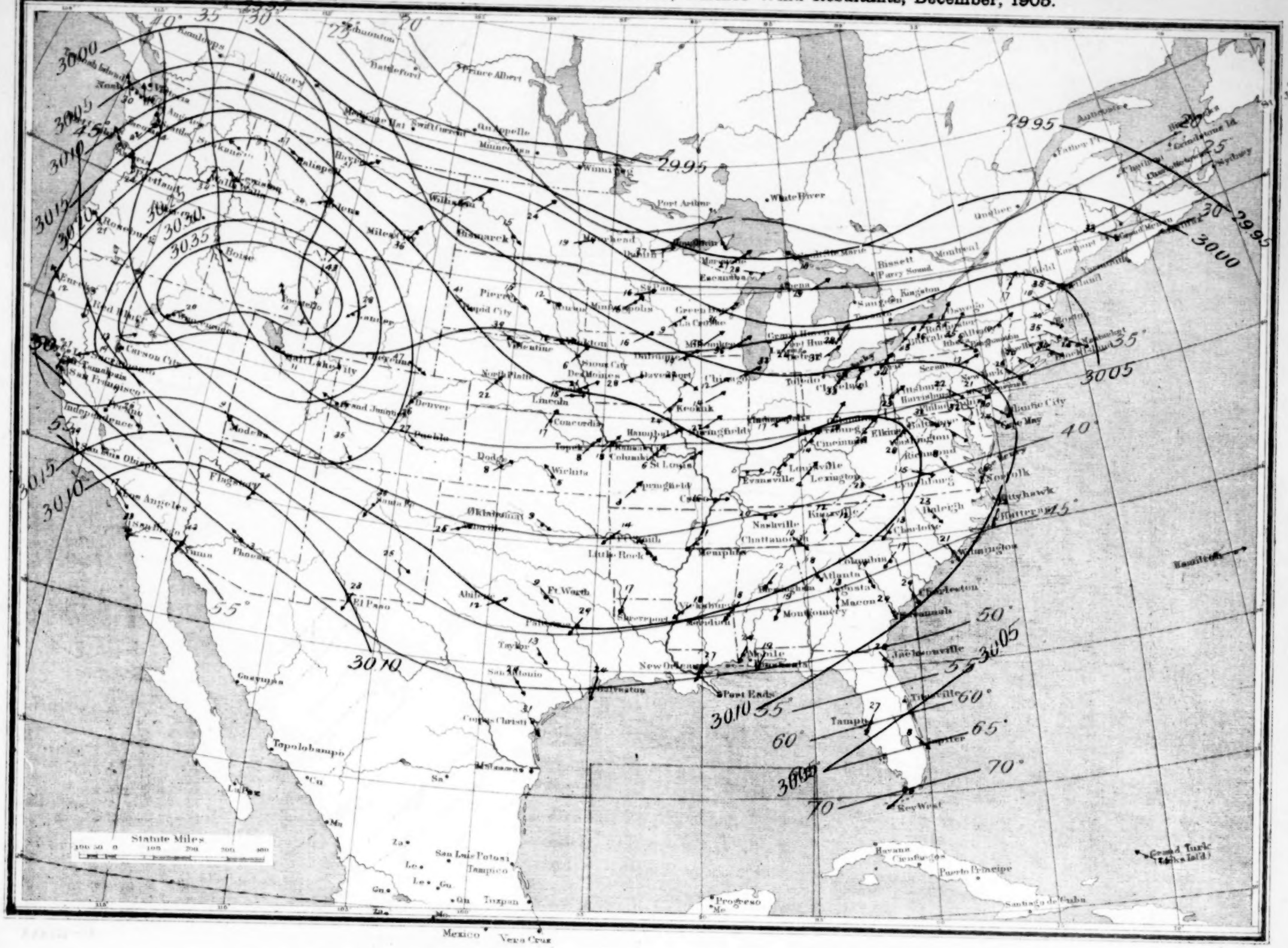


Chart IX. Sea-Level Isobars; Surface Temperatures and Wind Resultants, December, 1905.

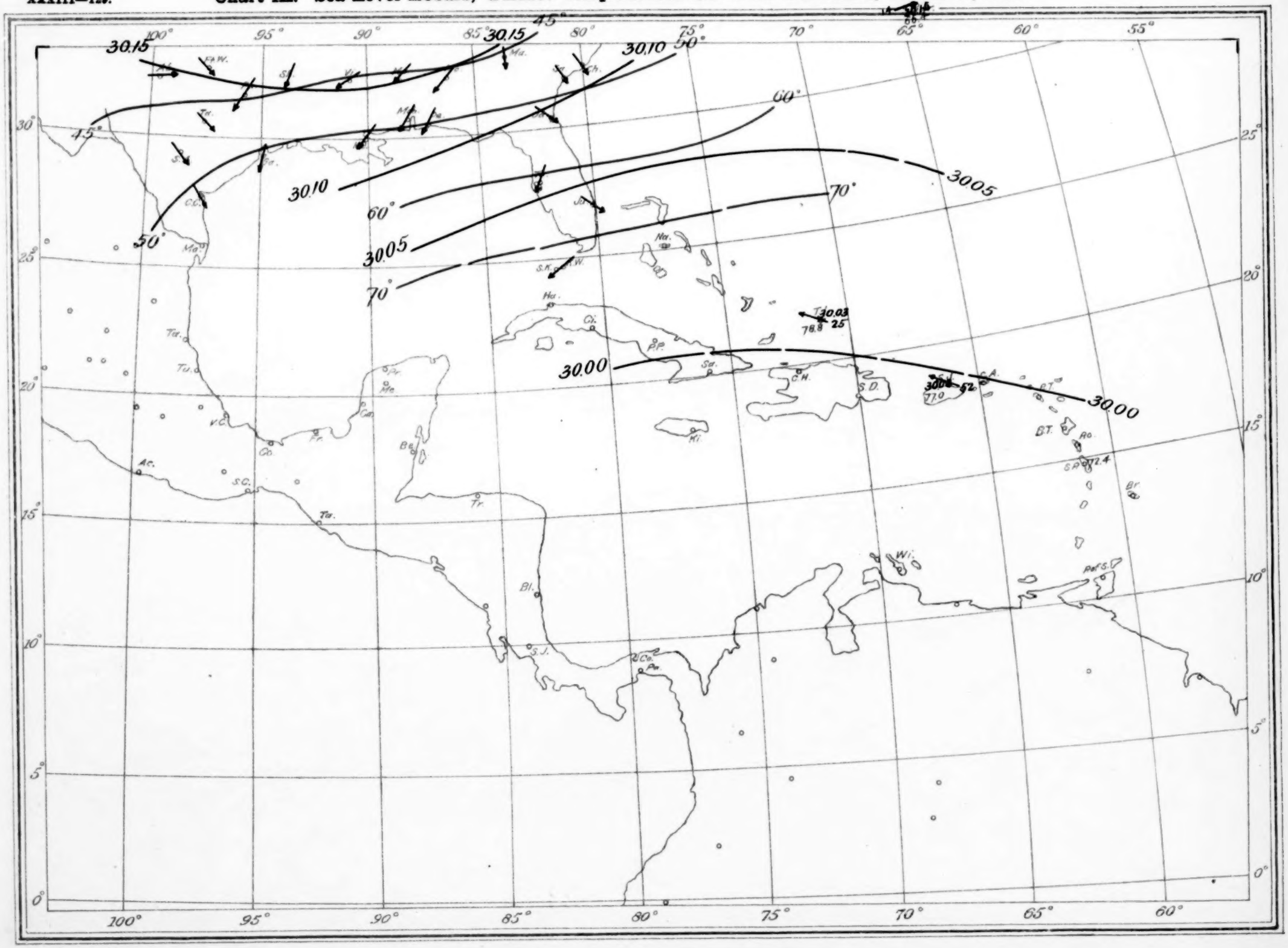
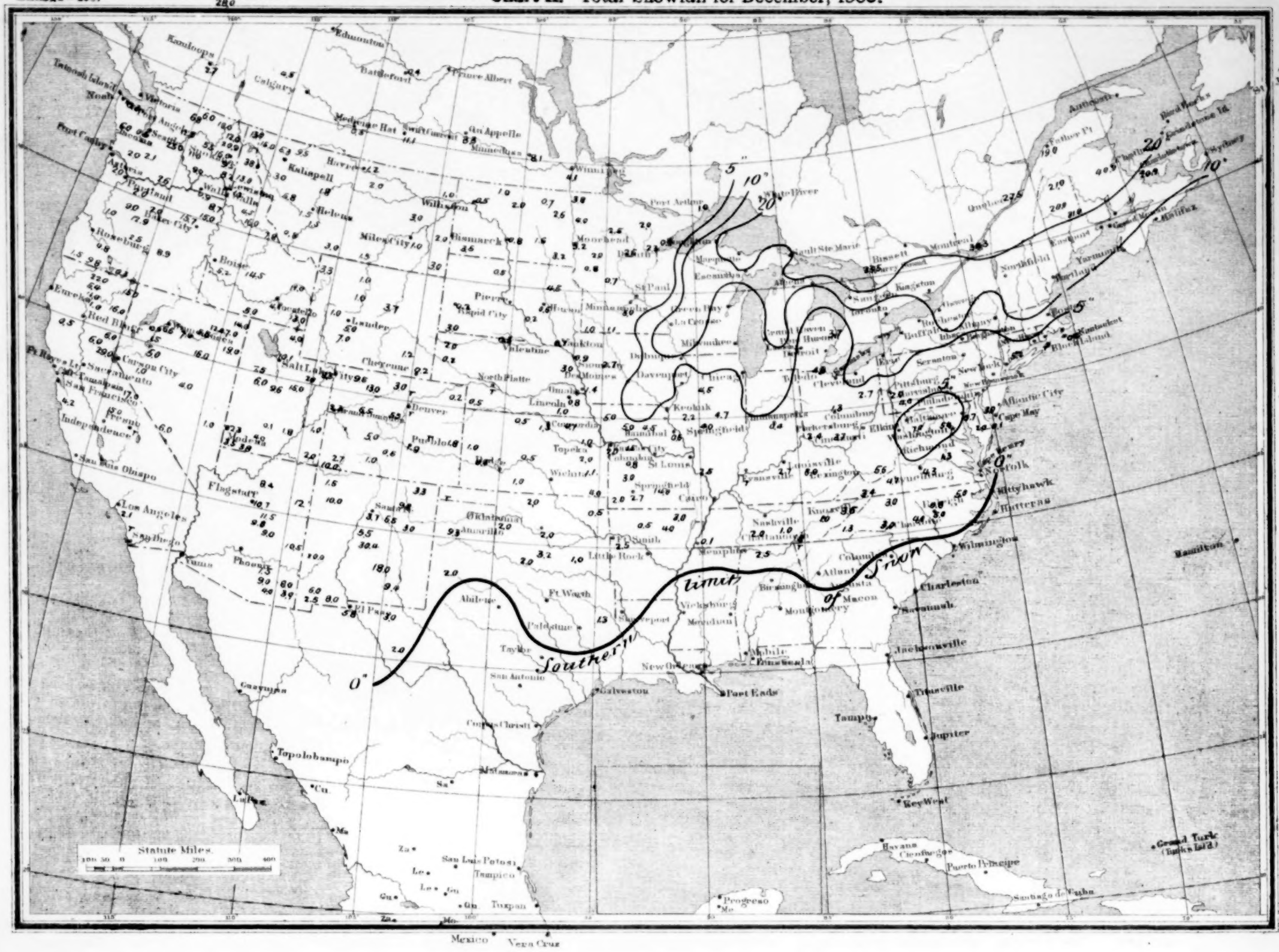


Chart X. Total Snowfall for December, 1905.



• Barkerville

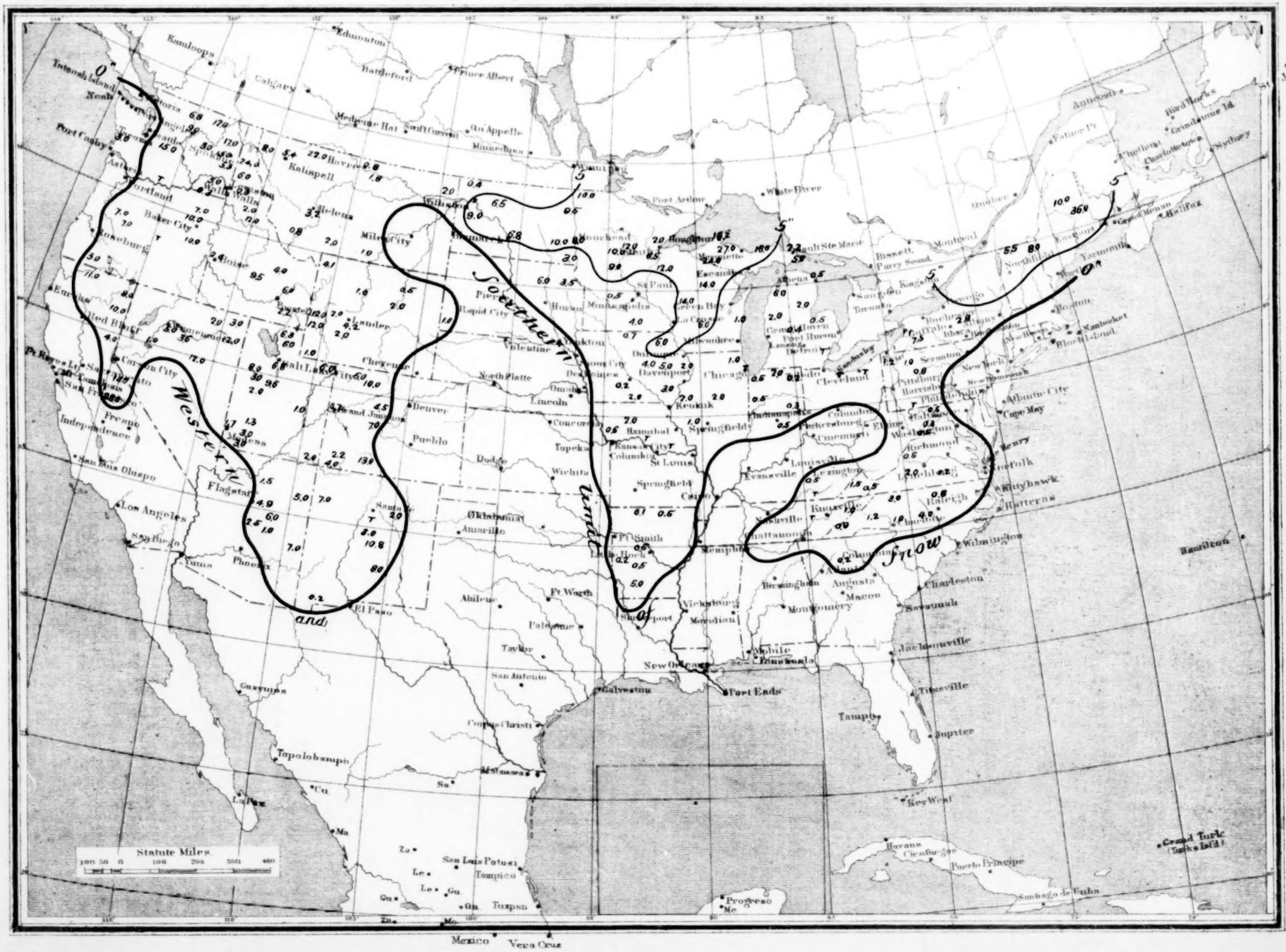



Chart XI. Depth of Snow on ground December 31, 1905.